AIRCRAFT MAINTENANCE AND FIRE

HEARING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS

OF THE

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AIRCRAFT MAINTENANCE AND FIRE

MONDAY, JUNE 27, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2318, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Present: Representatives Glickman and Carney.

Staff present: Anthony Taylor, subcommittee staff director; Harriet Smith, minority technical consultant.

Mr. GLICKMAN. Without objection, electronic media will be permitted to cover this hearing. Hearing none, so ordered.

Today the Subcommittee on Transportation, Aviation and Materials will examine two critical issues that we have been involved with for some period of time: aircraft maintenance and aircraft cabin fire safety research.

During the last several months there have been a number of incidents involving major airline aircraft, and one serious inflight fire which resulted in the deaths of 23 individuals. By my count there have been about 20 such incidents, many of which may be related to aircraft maintenance problems. The examples that received the most attention included:

April 4—Republic DC-9 fuel-starvation flameout north of Bryce, Utah.

May 5—Eastern L-1011 emergency landing at Miami with all engines disabled or damaged by oil starvation.

May 28—Republic DC-9 zero-fuel emergency landing at Luke Air Force Base in Arizona.

June 13—United 727 engine failure after takeoff from Washington National Airport.

June 11—United 727 aborts takeoff at Chicago after engine failure and reports of engine fire.

In addition to these incidents, the Air Canada inflight fire near Cincinnati vividly illustrated how quickly an aircraft emergency can turn to tragedy.

Last summer the subcommittee recommended that the FAA adopt new cabin fire safety standards based upon technology developed through the fire-blocking layer research program. That program has been very successful in developing less flammable materials for aircraft seats. The FAA has all the information they need to upgrade the current standards, and if they have no plans to do

so, this subcommittee wants to know why. We are also interested in hearing what plans the FAA has in mind to improve the current service difficulty reporting system.

These issues that we are going to discuss today raise two larger, more general questions: Is the unprofitability of the airline industry in general contributing to this perceived increase in near accidents, or are these incidents the inevitable consequence of human errors? The technology is available to improve the safety of aircraft, but is the money available to buy this technology?

I want to thank the expert witnesses that have agreed to assist us today as we consider these important issues. I look forward to an informative and productive hearing.

Now, I would like to call on the ranking Republican member of the subcommittee, Bill Carney, of New York.

Mr. CARNEY. Mr. Chairman, I look forward to this hearing. We must realize that aircraft travel in the United States is the safest mode of travel there is in the world. It is approximately 30 times safer than traveling by car. However, we do see a trend, that the chairman spoke of in his opening statement, of many near misses, some accidents, some which have led to fatalities, and I think this trend certainly deserves close scrutiny by this committee.

I look forward to hearing the witnesses who will testify today to find out the answers to some of those questions. Indeed, is it just a coincidence that so many mishaps or near mishaps have happened in such a short time frame, or is something going afoul? Is it the age of the equipment, or perhaps the industry is becoming lax in meeting its safety requirements and in its everyday approach to safety?

I think with that, Mr. Chairman, I look forward to hearing our first witness.

Thank you.

Mr. GLICKMAN. Thank you, Mr. Carney.

Without objection, statements of any other member who wishes to put an opening statement in will be included in the record.

[Input included in Appendix.]

Mr. GLICKMAN. Our first witness today is the Honorable Jim Burnett, Chairman of the National Transportation Safety Board, who has been before this committee and others many times in recent weeks and months.

It is a pleasure to have you here, Jim. You may proceed.

STATEMENT OF JIM BURNETT, CHAIRMAN, NATIONAL TRANSPORTATION SAFETY BOARD, ACCOMPANIED BY WILLIAM G. LAYNOR, DEPUTY DIRECTOR FOR OPERATIONS, BUREAU OF TECHNOLOGY

Mr. BURNETT. Good morning, Mr. Chairman.

I am pleased to be here today on behalf of the National Transportation Safety Board. It is my understanding that the subcommittee is interested in hearing from the Safety Board on the subject of the Federal Aviation Administration's—FAA—role in air carrier maintenance surveillance; in particular, its service difficulty reporting system. I will also be prepared to respond to general

questions on the subject of aircraft cabin fire safety, although the Safety Board's ongoing investigation makes inappropriate any detailed discussion of the recent Cincinnati Air Canada accident involving an inflight fire.

Before going into my testimony I would like to introduce Mr. William Laynor, Deputy Director of the Bureau of Technology.

Air carrier maintenance surveillance is an issue that has been of considerable concern to the Safety Board for a number of years. The tragic crash of an American Airlines DC-10 in Chicago on May 25, 1979, involving maintenance-induced structural damage to the aircraft prior to the accident, served to highlight the importance of reporting, analyzing and disseminating information related to maintenance.

On May 5, 1983, we were reminded of this fact once again when an Eastern Airlines L-1011, enroute from Miami to Nassau, lost power in all three engines due to oil starvation caused by the improper installation of chip detectors on each engine without oil seals. Fortunately, in this instance a disaster was averted.

The safety of commercial aviation is dependent on a number of factors, and particularly on proper maintenance surveillance designed to detect and prevent problems that have a potential for disaster. Given the complexities of modern aircraft design and the millions of aircraft operations each year, this task is formidable indeed.

In an attempt to insure the highest level of safe operations throughout the service life of an aircraft, the FAA, working with the industry, has developed comprehensive maintenance surveillance programs. An integral part of this complex system is the continued monitoring of problems encountered by the aircraft as it ages, the identification of their origin, and the institution of corrective actions taken before they result in an incident or accident. The success of this effort relies partially on the FAA's service difficulty reporting system which involves the collection, analysis and dissemination of reports of service problems.

The way the SDR system is designed to work is that an operator is required to submit a daily report to the FAA maintenance inspector assigned to its operations describing the occurrence or detection of any failures, malfunctions, or defects as defined in the regulations.

For example, they include inflight fires, engine shutdown under some circumstances, aircraft structural damage caused by certain component or system failures. The aircraft manufacturer and authorized repair stations are subject to similar reporting requirements. The FAA collects these reports, analyzes them for trends, and disseminates the SDR's throughout the industry.

The Safety Board recognizes the magnitude and complexity of this task, and supports the FAA's current efforts to improve the efficiency of the system by incorporating it into a highly automated aviation safety analysis system—ASAS. However, the current SDR system and the upcoming ASAS are only a portion of the FAA's surveillance function. Each is designed to augment the primary means of monitoring air carrier maintenance operations, which is accomplished through the personal oversight of the FAA principal maintenance inspector—PMI—located near each carrier's principal

maintenance facility. These inspectors review the carrier's continuing maintenance program and records to assure that the carrier complies with the regulations.

The Safety Board is concerned that there have been many instances in which problems have occurred and their significance missed—either because they did not fall into a required reporting category or were reported, perhaps repeatedly, but overlooked in analysis.

The Chicago crash in 1979 is a vivid example of an accident which might have been avoided had an earlier occurrence been reported and accurately analyzed. You may recall that the accident occurred when the aft bulkhead of an engine pylon failed and the entire pylon and engine assembly separated from the airplane as it was taking off. During the separation other structural damage occurred that affected the airplane's controllability. The pylon aft bulkhead failure was found to have resulted from fatigue emanating from a crack which had been caused during an earlier engine pylon assembly removal and reinstallation.

The procedure which the airline used during that maintenance operation differed from that recommended by the manufacturer. We believe that the procedure had not been analyzed adequately to determine whether or not there was a risk of damage to the aircraft structure.

The opportunity to analyze this different procedure presented itself when, 5 months before the Chicago accident, another airline damaged the same structural element, using the same maintenance procedure.

Although that airline knew the damage had occurred and the aircraft manufacturer had to be engaged to engineer a structural repair, the incident was not reported to the FAA. Why? The damage did not fall into any of the defined reporting categories. The one category under which it might have been reported was the classification of a major repair. However, the definition of major and minor repairs leaves too much room for subjective judgment, and the repair was not categorized as major.

The Safety Board believed in 1979 and continues to believe now that had the initial occurrence been reported and properly analyzed, the danger potential of the different maintenance procedure and the resultant structural damage would have been apparent and would have prompted inspections before the Chicago accident of other airplanes on which similar work had been performed.

After the accident the Safety Board issued eight safety recommendations to the FAA, two of which were intended to rectify what we perceived to be a shortcoming in its reporting requirements and maintenance surveillance. Specifically, we asked for more definitive requirements to assure that any damage to significant structure of an aircraft is reported so that the circumstances and consequences of the damage can be analyzed to ascertain whether it has broader application to other operators. We also recommended that the FAA become more directly involved in the approval of hazard analysis and new maintenance procedures when the procedures involve structurally significant components.

The blue ribbon committee convened by the National Research Council in 1979 issued similar recommendations, as did a mainte-

nance review management team assigned by the FAA to investigate air carrier maintenance practices following the Chicago accident.

We remain concerned because the FAA has not taken these recommended actions, although they did address other specific recommendations we made related to the DC–10's design and operational procedures. In response to recent correspondence wherein the Safety Board categorized those recommendations relating to maintenance surveillance and service difficulty reporting requirements as closed—unacceptable action, Administrator Helms cited the extensive SDR system and the development of the ASAS as adequate to address those issues. However, the fact remains that if it occurred today, an airline still would not have to report significant structural damage inflicted during maintenance. We believe and hope that such reports would be infrequent, but they should be required.

Furthermore, while we support an automated analysis system, we do not believe that it can be totally effective in detecting a potential hazard based upon an isolated occurrence. The system cannot be viewed as a substitute for the personal involvement of the air carrier maintenance inspectors.

As I mentioned at the beginning of my testimony, the need for better analysis of reported service difficulties was emphasized recently in the Eastern Airlines L–1011 incident. You will recall that the flightcrew shut one engine down when an oil low-pressure warning was received in the cockpit, and this was followed shortly thereafter by additional warnings and the subsequent mechanical failure of the other two engines because they were starved of oil. It was fortunate that the crew was able to restart the first engine to manage a safe landing.

While the investigation is continuing, we know that the oil was lost from all three engines because maintenance personnel omitted the installation of O-ring seals when they replaced magnetic chip detectors in the engines during a routine maintenance check. It was determined that there have been previous instances of oil starvation for the same reason involving this and other carriers, but on those occasions only one of the three engines was affected and the oil-starved engine was shut down with inconsequential results.

It is interesting to note that at least some of these shutdowns had been reported to the FAA's SDR system, although a precautionary engine shutdown in flight does not necessarily require reporting. You may be assured that our investigation of this occurrence will examine the disposition of the previously reported incidents by the air carriers and the FAA.

This completes my formal testimony. I will be pleased to respond to any question the subcommittee members may have.

Mr. GLICKMAN. Thank you, Mr. Burnett, for your testimony.

Let me just ask you a few questions on the maintenance issue. Then I would like to move to the cabin fire issue, if possible. In the last several months there have been a number of aircraft incidents, or near incidents, some of which I mentioned in my opening statement. Has the NTSB looked at these trends to determine if they represent an unusually high number of near incidents?

Mr. BURNETT. We have probably investigated more incidents in the first 6 months of this year than we do ordinarily. I think the record for any year is about 27 incidents being investigated. We have had 26 already. But if you look at the year in which there were 27, 20 of them occurred in the last 6 months. So the streak that we are experiencing is not unprecedented, and I see no reason at this time to believe that it is anything more than a streak.

To use the term "trend," might be interpreted statistically to have some meaning that I don't think we could give to it at this time. Also, these figures, of course, are influenced by the decision of the Safety Board to investigate incidents. It is currently the philosophy of the Safety Board that we can gain a lot of safety information from these investigations and that the seriousness of the accident or incident in terms of lost life is not necessarily the most important factor in determining what we investigate.

Mr. GLICKMAN. You indicated in your testimony in connection with the Lockheed-1011 situation, I assume you are investigating that particular incident.

Mr. BURNETT. Yes, we are certainly.

Mr. GLICKMAN. But a precautionary engine shutdown in flight does not necessarily require reporting.

Mr. BURNETT. That is correct.

Mr. GLICKMAN. That concerns me. If it doesn't require reporting how are you or any other carrier going to know what the nature of that problem was on a precautionary basis?

Mr. BURNETT. Mr. Laynor?

Mr. LAYNOR. Well, Mr. Chairman, the shutting down of an engine in flight may require reporting. If it requires deviation from the aircraft's schedule, it requires reporting under the interruptions report requirement. There are a number of times when aircraft engines are shut down for precautionary reasons which are not reported. But we certainly hope that those times in which they are reported are sufficient to provide an indication of a problem.

Mr. GLICKMAN. Whose judgment is it whether to report this or not?

Mr. LAYNOR. Well, it is regulatory under certain conditions. If an uncontained engine failure occurs which results in aircraft structural damage, that is a required reporting. In merely precautionary shutdowns where the crew for some reason or another believes that they have an engine problem and they can continue to land at their preplanned destination, that does not require reporting.

Mr. GLICKMAN. But the United 727 that left Washington National and came back because of an engine shutdown, that would have required reporting because it did not go to its completed destination?

Mr. LAYNOR. That is correct.

Mr. GLICKMAN. I guess my concern is that as aircraft get older, as we have structural defects occur because of that, I would want to insure that there is a complete and full reporting of every potential problem to the FAA and to other carriers as well, so they can avoid potential maintenance problems. I gather, maybe you can correct me, that you indicate, Mr. Burns, in your testimony that the service difficulty system can be improved.

Do you see an opening here where unreported errors can occur, unreported problems?

Mr. BURNETT. We certainly did in the investigation of the DC–10 crash in Chicago where we found that there had been, as I mentioned in my testimony, a procedure used in maintenance by Continental Airlines which resulted in structural damage to the engine mounting. And this information, of course, was not reported to the FAA and, therefore, could not be used to correct that problem and change the maintenance procedure, the same maintenance procedure that was being used by American Airlines.

That is an example of our concern. I think the problems here are twofold. One is there needs to be a broader reporting system so that some of this information can get into the hands of the FAA. And there needs to be improvement in the analysis of the information, once it is in the system.

Mr. GLICKMAN. You have criticized complete reliance on an automated analysis system as not being effective in detecting a potential hazard based upon an isolated occurrence.

Mr. BURNETT. That is one of the points, if you are just looking at trends. I don't know that the FAA is planning to do this, but if their system results in looking totally at trends, at statistical information, the very important information that might be revealed from a single occurrence may be neglected. The chance to have caught something like the DC–10 problem and avoided the accident as a result of the Continental experience would be lost, as it was in that case, because of lack of reporting. But the same thing can result from lack of analysis.

Mr. GLICKMAN. Let me ask you this. Do you characterize the fact that the service difficulty system can be improved, do you characterize this as a major or minor problem with respect to the current system of reporting problems, maintenance problems?

Mr. BURNETT. Certainly, to the extent that it was reflected in our recommendations we made due to the DC–10 accident, it is a major problem. That was a major accident, the largest accident we have had in U.S. air carrier history. It could have been avoided, we think, if there had been better reporting.

Mr. GLICKMAN. Since that time, what I am trying to figure out, do we still have holes in the reporting system?

Mr. BURNETT. Yes; the recommendations we made for improvement of the reporting system have not been adopted by the FAA.

Mr. GLICKMAN. Now, let me go back to page 6 of your testimony which said the Safety Board is concerned that there have been many instances in which problems have occurred, and they are significant and have been missed. At the bottom of page 10 I want to find out what this means exactly: In response to recent correspondence wherein the Safety Board categorized those recommendations relating to maintenance surveillance and service difficulty reporting requirements as closed, unacceptable. Administrator Helms cited the extensive SDR system and development of the ASAS as adequate. What is meant by closed, unacceptable?

Mr. BURNETT. Here is the way the Safety Board works in pursuing adoption of its recommendations; first we make the recommendations. We give the agency to which we have made the recommendations an opportunity to respond. If they indicate some interest in

pursuing the matter, we usually state that that recommendation is to be held open, acceptable action.

That is the case we followed with recommendations that we made to the FAA as a result of the DC–10 accident. If eventually they carry forward with their expressed intention to adopt the recommendation, we are able to close that out, acceptable action. However, if we see that progress is not being made, if they finally refuse to go forward with the recommendation, we close the recommendation, take it off our books and say that it is unacceptable action. That is what happened here in the DC–10 recommendations.

Mr. GLICKMAN. Specifically, again for the record, what has the FAA failed to do with respect to the reporting requirements which required you to make your file closed, unacceptable action?

Mr. BURNETT. There are several things. I will let Mr. Laynor elaborate on them. Many of them, the FAA had told us that they were going to do, and then subsequently decided they would not do. Among them we had recommended that they define the terms "major repair" and "minor repair" so that air carriers or manufacturers would have guidance as to what needed to be reported under the category of a major repair.

We wanted them to include any kind of damage to significant structural items as part of major repairs. And the FAA actually put out a notice of proposed rulemaking in this matter, and then, because of adverse comment from aircraft maintenance people and air carriers, withdrew that. That is one example.

Mr. Laynor, would you like to continue?

Mr. LAYNOR. Well, some of the other recommendations which we have closed involve the observation and analysis of hazards that might be associated with the deviation in maintenance procedures, or the establishment of new maintenance procedures. We believe here that there has to be a little bit more personal involvement by the FAA inspectors to be aware that a carrier is undertaking some new maintenance procedures, to find out what observations have been given to those procedures to insure that they don't pose a risk to significant structure of the aircraft.

We feel something like a fault analysis of maintenance procedures such as is required during the certification of the airplane itself is in order.

Mr. GLICKMAN. Let me move on quickly to the area of cabin fire safety. Then I want to ask you just a couple of questions. Just for a little background, what recommendations have you made to the FAA regarding postcrash fires and cabin fire safety?

Mr. BURNETT. Well, we have made numerous recommendations, Mr. Chairman. Among them are recommendations to improve their standards for flammability, or to decrease the flammability of materials used in aircraft, including seat covers and paneling materials. We have made recommendations for smoke detectors in lavatories. We have made recommendations for safe contained breathing apparatus so that flight attendants would be able to enter an area that might be obscured in smoke to be able to use fire extinguishers directly on the base of the flame.

We have been very concerned, although I don't know that we have a formal recommendation on it, we have certainly commented

on the need for less toxic materials than are being used in aircraft interiors. We have supported efforts to install fire resistant windows so the exterior fires could be restricted until there is adequate time for evacuation.

We have favored the development, as I mentioned, of the fire blocking seat cover materials which we believe is adequate not only from a technical standpoint, but from economic, weight wear and comfort standpoints as well. These are some examples of the recommendations we made.

Mr. GLICKMAN. I am sure you are aware that the FAA has been conducting research for quite awhile on the issues of flammability, toxicity. This subcommittee has jurisdiction over some of those areas. Much of that has been done at the technical center in Atlantic City. Do you think that there is any reason now why the FAA should not upgrade their flammability standards?

Mr. BURNETT. No.

Mr. GLICKMAN. Thank you.

Mr. Carney?

Mr. CARNEY. Thank you, Mr. Chairman.

I have one question. We talk about the reporting systems having some problems that obviously would be corrected. But could we get into a situation where we might be crying wolf, where there would be so much reported, that these reports of incidents of maintenance difficulties would be taken for granted and would just pile up in the corner somewhere and perhaps no one would see a trend?

I can appreciate your position; we are not looking for the trends, we are looking for the first occurrence.

Mr. BURNETT. Well, we are looking for trends. I don't want to throw any cold water on the ASAS system that the FAA is seeking to implement, because that is very important. As the Administrator has said, and I am sure will repeat, there are about 23,000 reports in the SDR system already being made annually, so it is a large volume. They are having to analyze that entirely in a manual fashion. That needs to be corrected, and I commend him on his action to do that.

If damage resulting to structural items during maintenance are not required to be reported, I would hope that the addition of those items would not substantially increase the 23,000 SDR's that currently must be made. If, however, there are so many of them that it would substantially increase it, that is all the more reason we need to know that. So, I think that the benefit is proportionate to the numbers of additional reports that we have to make.

If those numbers are very large, then it is all the more reason that we need to know. The Administrator has indicated that he feels that increasing the reporting requirements would in some way inhibit the implementation of the ASAS system that he is calling for. I would certainly hope that would not be true.

In the first FAA response to the recommendation we made back in 1980, they indicated that they were going to expand the reporting requirements as we had requested, and cited the plans that were being made for the computerized system at that time. So, I do not understand why these expanded reporting requirements have not been included in the planning for the computerized system all along.

This reason for not adopting the Board's recommendations was not given to us until after we closed out these recommendations unacceptable in our letter of May 17. Prior to that time the reason given to us was that the economic burden exceeded the benefits, and it was not made clear whose economic burdens, whether it was that of the air carriers or the FAA, although I had thought the meaning of that phrase was the economic burdens that it might place on the manufacturers or air carriers that were required to make the reports.

Since then there has been some indication in the Administrator's reply to us that this burden would be a burden on the FAA as it moves to implement its ASAS system. Now, I don't think the Safety Board has a problem with lack of patience with the FAA. And I think that the 4 years that we have spent trying to get these recommendations adopted is indicative of that. If they are going to adopt our recommendations for expanded reporting, but the timing is wrong, I would be pleased to hear that. At least we might not be satisfied, but I would consider that a breakthrough.

We certainly don't want to cause the Government any inefficiency. By the same token, efficiency in Government sometimes demands that we take action that needs to be taken.

Mr. CARNEY. Well, you are citing one specific thing that you asked the FAA to change in the reporting process. Do you feel that there are others of significance that you have recommended, that the FAA has not yet included in the reporting process?

Mr. BURNETT. Well, our major recommendations were that they define major and minor repairs which they at one time seemed ready to do, but they have not done. And the other was the necessity of being sure that maintenance induced damage, as opposed to damage that may have occurred in flight, would be reported, which it was not, and might have made the difference in the DC–10 case.

Mr. CARNEY. Those are the two major reporting corrections you would like to see?

Mr. BURNETT. Is there anything that I am missing?

Mr. CARNEY. There was one I picked up on. It was my understanding, now, that reporting an engine failure or shutdown would be required only if the plane did not reach its destination; is that correct?

Mr. LAYNOR. Well, by the present regulations, that is true. We don't have a great deal of difficulty with the present regulations regarding precautionary engine shutdowns. Those that are catastrophic in nature, uncontained failures and such, are reported to the FAA. They are also reported to the NTSB.

Mr. CARNEY. Would I not be correct in saying that if the plane from Miami with the missing O-rings had been going somewhere with an airfield the same size as the Miami airfield that the pilot's judgment might have been to continue—since he was very close to his destination—land, and we would never have known anything about it; is that correct?

Mr. LAYNOR. Well, oftentimes carriers do voluntarily report items in excess of those required by regulations.

Mr. CARNEY. But by the regulations it would not have been required for that to have been——

Mr. LAYNOR. It would if more than one engine failed.

Mr. CARNEY. A multiple engine would?

Mr. LAYNOR. Yes.

Mr. BURNETT. However, Congressman, I think the point is well taken and that is something we will have to consider in our investigation of the L-1011 accident. That particular matter has not been the subject of a recommendation that we have yet made to the FAA. It will have to be considered, I think, in the course of our investigation.

Mr. CARNEY. What I am confused about, is that it is significant to report an engine shutdown because the plane didn't make its destination. Oftentimes it would be procedure prudent for a pilot to go to the destination, because of a better equipped airport, better weather conditions, maybe he is more than 50 percent through his flight and he could arrive socner. So it doesn't make sense to me that we arbitrarily say if you reach your destination don't worry about an engine shutdown.

That is a logic—the logic that I am applying, is that of a Congressman and not a safety expert.

Mr. BURNETT. A very valid point. I think the other thing we are going to have to consider in our evaluation of that matter is the other point you raised. I don't know what we are going to do to the system if we ask to have all engine shutdowns reported. So as I say, that is something that I don't want to say no to because that is something——

Mr. CARNEY. I can appreciate what you are saying. It goes back to my saying, will we be crying wolf.

I would like to move on to the question of the age of the aircraft. We see the L-1011, the DC-10, several other recent aircraft incidents happening not to older planes but to newer planes. Do you know of any trend where there might be more of these incidents related to older planes than newer planes, or would it be equal, or are the newer planes having more difficulty?

Mr. LAYNOR. Well, I don't believe that we have undertaken a study to really evaluate the number of incidents that are occurring to older or newer aircraft. Many of them, of the incidents that we do investigate, seem to occur because of the large population——

Mr. CARNEY. Excuse me. I don't think your microphone is on, sir.

Mr. GLICKMAN. It is. He needs to bring it closer.

Mr. LAYNOR. Now? We have never undertaken a study to relate incidents to aircraft age. Certainly there are certain unique occurrences that we can attribute to aircraft age, structural fatigue and such. In the case of some of the recent incidents, I think that it is probably more pertinent that the population of aircraft in service is quite large, and therefore the incidents occur to those aircraft.

Also, in some of the incidents the chairman referred to in his opening statement, they are very broad in nature. There is very little similarity in many of them. They encompass both maintenance, dispatch, operational procedures, and they are very wide in scope.

Mr. CARNEY. Does your Agency, Mr. Burnett, look into things like morale of employees in the aircraft industry, that type of thing, that might be attributing to improper maintenance, or are the crews working too long?

Mr. BURNETT. It is our intention to look into all such things in the course of accident investigations. We do not do generalized studies to go in and investigate the morale of the aviation industry. But in the course of accident investigation, we attempt to expand the emphasis that we give on human performance. That of course includes all matters that may impact upon human behavior and human attitude. The matters that you mentioned would be included.

It is my feeling that we have not done as good a job in the past as we should have in dealing with human performance questions as opposed to mechanical issues. That is one of the directions we are now pursuing including what we are now seeking to do, adding substantial new staff with expertise in that area.

Mr. CARNEY. I have one final question, Mr. Chairman. I appreciate your diligence.

On the question of cabin safety and flammability you have made recommendations to the FAA about that. They were published and, if my memory serves me correctly, there was an enormous criticism from many quarters, saying that we weren't in a position to move forward. The technology wasn't there, or for various different reasons, everyone said it was impossible to move forward on that.

Question No. 1, it is a three-part question.

Mr. BURNETT. I will try to remember all three parts.

Mr. CARNEY. That first the technology might be here now; second the FAA is pursuing this in a prudent fashion with the work that they are doing in this area, and I have had the opportunity to visit the Atlantic City facility and watch them demonstrate some of their programs on flammability; and third do you think if the state-of-the-art is here it should be a requirement to retrofit existing commercial aircraft?

Mr. BURNETT. OK, I will try to remember all three parts. I may muddle them up a bit.

Mr. CARNEY. The reason I did that, I was afraid I might lose my time.

Mr. GLICKMAN. The gentleman has as much time as he wants.

Mr. CARNEY. OK.

Mr. BURNETT. I think you have to look at it issue by issue. Many of the recommendations the NTSB has made have been longstanding and there have been substantial changes in technology since we first made them. The Board again has been very patient, perhaps too patient, with the FAA in rating responses to those recommendations as acceptable pending further research.

In the area, for instance of fire blocking material on seats, I think, and I believe the industry sees this, that all has been done that needs to be done to implement that. Not only from the technical research standpoint but from research on the economic feasibility, the comfort and those issues. So we are ready to move on that. Any further delay is inexcusable as far as I am concerned.

I don't say that being critical because I am very hopeful that there will not be any further delay.

On the issue of toxicity, I think we still need to know an awful lot. I am not sure we are ready to deal with that in any kind of comprehensive way in terms of setting standards. I don't want to have a closed mind on that because that is something we are going

to have to consider in relation to the Cincinnati accident, but certainly I have some concerns about the state of our technical advancement.

We are in a position, I believe, to begin to rate materials that are being used as far as toxicity is concerned, although we have an imperfect understanding as to how toxicity on rats relates to that of primates or humans. I think we are in a position to begin to ban perhaps some materials that have toxicity peculiarities that are unacceptable in aircraft.

But we are a long way I think from being able to deal with that comprehensively, and we need to do further research. I think we are also ready to move on the improved windows that will be fire resistant and will give extra time, 4 or 5 minutes extra time, for passengers to evacuate in the event of an exterior fire, post-crash fire or in-flight fire that is exterior to the aircraft.

So there are a lot of areas we can move on at this time and we should move on, and other areas the FAA should continue its research in.

Mr. CARNEY. The question of retrofitting, in the areas you say we should move on. For instance, flammability of the seats, that type of thing, seat blocking. Do you think there should be a requirement to retrofit?

Mr. BURNETT. Aircraft are refurbished fairly frequently. And I think maybe the industry could give you a better idea than I could, more accurate, as to how often that is. But my impression is, at least every couple of years. So I think that we should certainly expect any new innovations to be accomplished at the time of refurbishment. And we should not allow laggard operators to extend the time of refurbishment beyond that which is standard in the industry in order to delay having to put in the improvements.

So I would hesitate to give a time. Even though some of the things are now available we will have to allow time for them to be produced.

Mr. CARNEY. You are saying, then, in essence, that retrofitting is feasible, and should be done on a schedule that would allow for the production of the materials and would fit with retrofitting calendars, since planes are retrofitted every couple of years?

In fact, the DC-9 Air Canada plane was retrofitted not long before the accident.

Mr. BURNETT. Eighteen months before.

Mr. CARNEY. The last question is maybe more of a statement than a question. But I asked about the FAA. They have in the last 2 years been buffeted first with the strike by the air traffic controllers, second with changing the National Airspace System. They are moving on. They are modernizing the air traffic control system in its entirety. They are bringing on a new generation of computers. They seem to have a large plate in front of them. They have a large appetite to improve the traffic safety performance of our aviation industry.

How would you under those circumstances rate the job the FAA is doing? That is the hand grenade question.

Mr. BURNETT. OK. I am going to say something else while I think about that question a little bit. One thing we have not mentioned that I certainly do not want to leave this table without getting into

is the NTSB's recommendations about improving lighting for evacuation purposes. If people cannot find their way out, regardless of the time that you buy them with fire blocking seat materials or improving toxicity, it is not going to achieve anything. It is very important that people be able to get out. We don't know what impact right now that that may have had on the fire incident under investigation.

Mr. GLICKMAN. Would the gentleman yield on that question?

Mr. CARNEY. I would be more than glad.

Mr. GLICKMAN. Is this in a specific recommendation that you have made.

Mr. BURNETT. Yes. We have made a recommendation for improving lighting. We believe that that can best be done by lowering the lights, putting them down at armrest level. This came to my mind, I am sorry I neglected it when we were talking bout retrofitting.

You know, now we have in most of our aircraft little buttons on the side where we can turn on lights and call the flight attendants, and we have ear phones and all that. The seats are electrified. It doesn't seem to me to be technically unfeasible that we also put exit lights and markers for emergency evacuation purposes at least at the armrest level. That came to my mind. I would have been remiss if I didn't get that in.

Now, let me go back, if I may, to the question you asked. I feel that the FAA, as you say, does have a lot of fine, outstanding plans for the future. And I believe that the leadership the current Administrator has provided will bear some fine things for this country when his plans are completed. One of the fears I have is that, of a lack of followthrough. I hope that the agenda he has outlined, some of which will not be implemented for several years even if they proceed as scheduled, will all be achieved. I think it is important that we remember that the FAA also has to be responsible for those that are up there right now, not only for their children.

The general problem we have in Government is lack of long range planning, lack of consideration for the next generation, either technologically or physically. I guess the extent that I am concerned is that in making the great plans for the future, we not neglect the very mundane aspect of providing for the safety of our current generation with the generation of technology that we now have available. So I am going to resist the temptation to give, well, it is not a temptation, I don't have the temptation to give A's, B's, C's, or D's, but I will say that I am an admirer of Administrator Helms' work, even though on some issues I sharply disagree with him.

Mr. CARNEY. Thank you very much.

Mr. GLICKMAN. Just before you leave, I know your back is bothering you, but I just think you might be helping the flying public, so let your back bother you just for a couple more minutes. I just want to tell you that in the bottom of page 12 of your statement on the O-ring thing again, back to the L–1011, to think that a plane could have gone into the Atlantic Ocean because a mechanic would have failed to put O-rings on three engines is an absolutely inconceivable action in my mind.

You have at the bottom it was determined that there have been previous instances of oil starvation for the same reason. I assume

because a mechanic failed to put an O-ring or something like that, involving this and other carriers. But on those occasions only one of the three engines was affected, and the oil starved engine was shutdown with inconsequential results.

Now my question is, because of the fact as you and your colleague have talked about, that not every engine failure has to be reported, how many reported cases have there been in recent history, failure to replace an O-ring on an engine?

Mr. BURNETT. That is still a matter of investigation. There have been several. We discussed numbers in the deposition session I held in Miami. I am still not satisfied that we know in terms of numbers. Some of those reports that have been listed may have been somewhat different problems, although they are related to either chip detectors or O-rings. We may not still know all of them. So I am not sure that we are at the point of discussing numbers.

But it is safe to say that there had been instances before that had come to the FAA's attention. The FAA had discussed it to some extent with Eastern.

Mr. GLICKMAN. You mean there had been problems with Eastern on the O-rings?

Mr. BURNETT. That is correct. We now have to look to see what happened as far as followthrough on that. We do have an issue—and I don't want to prejudge—but I think we have a much larger issue, and perhaps a much more important issue, of quality control. We also have the issue of the effectiveness of the FAA's maintenance inspection program, to deal with this.

In our hearings that we conducted in Miami, I found a reluctance, first on the part of the supervisors of the mechanics with Eastern Airlines, to get out on the flight line and be sure that the procedures they outlined were actually being followed. Their training technique was to put up notices on the bulletin board and to make announcements at the beginning of the shift. As far as I could learn, there were no procedures for determining whether or not that training was being effective.

I made the same inquiry of the FAA and sensed the same problems. I asked a question down there in which I was seeking the FAA to reassure the public that they were going to go out on the line and be sure that the new procedures that Eastern had entered into after the accident were, in fact, being adopted and used, because the procedures were not being followed prior to the incident. I found the FAA inspector reluctant, apparently, to say that he was going to actually look over the shoulder of mechanics to see what was being done. He repeatedly told me that he had talked to the vice president of the airline. I finally made the comment, rather in exasperation, that vice presidents don't put on O-rings, so we are going to have to get beyond that level.

I think among the recommendations that came out of the various studies that were done following the DC–10 accident was the need for more spotchecking. I realize that the FAA personnel to do this sort of thing is limited and that they do have to delegate these functions largely to the carriers, and that much of their work has to be reviewing their procedures. But the best procedures are not going to be effective unless they are used. And any program for training must require some sort of procedure to check to see if the

training actually is being effective. There has to be some feedback mechanism.

Mr. GLICKMAN. I would just say this: If we didn't have the most skillful pilots in the world, that plane could have gone into the drink and nobody would have ever known what caused those engines to fail. We would have speculated, but we would have not known because I am sure that a mechanic wouldn't have said "I forgot to put the O-ring on." And the fact of the matter is that it is extremely disturbing to see that even if we have the systems right and even if we have the regulations on the books, that we may have a serious followthrough problem here which could be compounded by the fact that we have lots of struggling carriers right now and carriers that are operating in a deficit financial position, a lot of new deregulated carriers that may not have the experience in doing some of these things that you talked about today.

I don't mean to imply that we have got a crisis now, but I think that it is useful that you, at the NTSB, continue to follow through on this very, very carefully, because it concerns me very, very much.

Mr. BURNETT. I assure you, Mr. Chairman, that we will follow through.

Mr. GLICKMAN. Thank you very much, Mr. Burnett. I appreciate your being here.

Our next witness is the Honorable Lynn Helms, Administrator of the Federal Aviation Administration.

Lynn, I know you are accompanied by several folks. You may want to introduce them. I know you have a prepared statement, and I also know that we may get into the issue of cabin materials, which I think we will talk about afterward in a question-and-answer session. So, Lynn, you may proceed as you wish.

STATEMENTS OF HON. J. LYNN HELMS, ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION; CRAIG BEARD, DIRECTOR, OFFICE OF AIRWORTHINESS; AND WILLIAM FROMME, DIRECTOR, OFFICE OF AVIATION SAFETY

Mr. HELMS. Thank you, Mr. Chairman.

I welcome the opportunity to appear before the subcommittee today to discuss the FAA's service difficulty reporting system. With me is Craig Beard, Director of the Office of Airworthiness; and Dr. William Fromme, Director of the Office of Aviation Safety.

If some of my other associates are required to answer detailed technical questions, I will identify them.

I am aware that the subcommittee is interested in discussing the National Transportation Safety Board's recommendation that the FAA expand its service difficulty reporting system. While we intend to refine and improve upon our reporting system, we have concluded it would be counterproductive to implement significant changes prior to the introduction of our Automated safety analysis system, ASAS, which will automate the service difficulty reporting program.

More specifically, the changes which would be required to expand/alter our current manual dominated reporting system would divert critical FAA resources—I refer specifically to talent,

not dollars—from the more important task of automating and improving our whole safety reporting system, and would likely delay implementation of this advanced system.

Let me put this into better perspective by first explaining how our current reporting system works, including the types and amounts of safety information already generated within that system, and then by describing our next generation reporting system, ASAS, which will offer substantial improvements over our current system, and is hopefully not far away.

The FAA's service difficulty reporting system is a comprehensive system for collecting, organizing, and disseminating information on specific problems which occur in aircraft systems and components. The purpose is to get the information to persons within FAA and industry who can analyze the data, spot trends, and take appropriate corrective action. It is a system which has been in place for many years, is continually improved, and has worked well, but not without flaws—and certainly not without need for further refinements and improvements.

Under our reporting system, we obtain reports from all segments of the aviation industry on significant kinds of failures, malfunctions, and defects in aeronautical products which could adversely affect the safety of flight. The service difficulty reports, SDR's, are coded and filed in a central computer for statistical and analytical purposes. Summary SDR's are published weekly to alert both FAA personnel and industry to potential problem areas. We currently receive about 23,000 SDR's a year from various segments of the industry. This figure includes those required by regulation, and also those submitted voluntarily.

Through the SDR program, we receive mechanical reliability reports from air carriers on problems which might endanger the safe operation of their aircraft; manfunction or defect reports, which must be filed by certificated air repair stations and part 125 operators concerning serious failures, malfunctions, defects, or other recurring airworthiness problems discovered in aeronautical products; and special reports are filed by FAA principal air carriers inspectors on significant failures, malfunctions or defects in the widebody fleet. Every carrier has an assigned FAA principal inspector.

To supplement the kinds of information received under the SDR program, we also require further reports from manufacturers and air carriers. Air carriers are called upon to file mechanical interruption summary reports for flight interruptions or an unscheduled change of aircraft en route or an unscheduled stop or diversion from a route that is caused by mechanical difficulties or malfunctions. Manufacturers are required to file reports with the FAA on 13 identified types of problems such as fires, braking system problems, engine failures, and the like, if they have not been reported by another source to the FAA.

Collection of all these data would be meaningless if they were not put to use. As I have indicated, appropriate FAA offices, often those in which the reports are initially filed, use the information to take corrective action, if needed. In addition, FAA circulates the information throughout the agency and the user community.

For example, a weekly summary of Air Carrier SDR's, containing approximately 8,800 reports filed by carriers each year, is circulat-

ed to approximately 535 airlines and other interested persons, as well as to all FAA Air Carrier District Offices, ACDO's, Flight Standards District Offices, FSDO's, and General Aviation District Offices, GADO's. The General Aviation weekly summary circulates about 750 selected reports per year to about 4,500 organizations and individuals as well as ACDO's, FSDO's and GADO's.

In addition, FAA sends out a monthly general aviation airworthiness alert to repair stations, authorized mechanics, air taxi operators, mechanic schools, and requesting mechanics, totaling about 19,000 recipients along with FAA ACDO's, FSDO's and GADO's. Manufacturers also receive a monthly summary of SDR's of interest to them. For those who understand the costs of reproduction and distribution, it is immediately recognizable that this is not an insignificant part of our budget. But it also shows that cost-benefit studies are not the only criteria where safety is involved.

Internally, we compile system analysis summary reports containing all SDR's on a specified aircraft system or component, and indicate recognized trends. Approximately 40 of these reports are circulated annually to the specific engineering segment responsible for the product involved, and to other interested segments of FAA.

FAA field office personnel, in the course of their surveillance and investigation procedures, make approximately 200 inquiries of the system per month. Furthermore, FAA and industry elements with computer capability have direct access to 120,000 records on line.

Obviously, with the passage of time and the proliferation of reports, problems have arisen with the service difficulty reporting system. It is a slow, labor-intensive system. Different regulations governing different reports make data extraction more difficult and costly than necessary. The system cannot respond readily to ad hoc questions.

In an effort to overcome these problems, FAA formed a task force last January to examine the system and determine FAA and user needs, and recommend ways to better meet those needs. To maximize effectiveness, suggestions must dovetail with the field modernization program and the aviation safety analysis system. It is the ASAS system which will give us the capability to automate the SDR program.

The ASAS program will consist of 382 computer/processing units anchored by a central information processing facility in our Aeronautical Center at Oklahoma City. Each district office will be connected through its regional office to the main computer. Headquarters in Washington will have direct access to the computer. Each district office, the regional office, and Washington headquarters will have a level of information processing to allow it to enter, store, retrieve, and print pertinent data. The service difficulty reporting system will be one important data base of ASAS. The automation capabilities of ASAS will greatly increase the quality, timeliness, accessibility, and distribution of the SDR data. Eventually, non-FAA parties will be able to directly enter data and obtain access to data in aggregate forms.

Additionally, we have under development an improved automatic trend evaluation and alerting system. This will give the aviation community valuable early warning of potential hazards or emerg-

ing problems. It will allow FAA to identify unsafe trends more quickly than currently possible, design and evaluate corrective action alternatives, and implement the most appropriate course of action.

We expect to implement a prototype SDR/ASAS by January 1984, with national implementation by the end of 1984. The revised SDR program—based on the work of the special evaluation team I mentioned earlier—will be incorporated into the ASAS by the end of 1985.

Thus, Mr. Chairman, we believe that the ASAS program now underway—which has been endorsed by the President's Task Force on Aircraft Crew Complement, the Blue Ribbon Committee of the National Research Council, and the GAO—coupled with our SDR task force work, will result in a vastly improved system that will best serve the interests of aviation safety. Through this comprehensive approach to upgrading the system, concerns such as those raised by NTSB will be addressed and appropriate changes will be made.

I would like to conclude my remarks with an update on a related issue. In July of 1981, GAO disallowed a vendor protest and implicitly concurred in FAA's selection of new computers to be used as major components of this safety system. Based on that, FAA moved forward to procure them. Recently, GAO reversed its 1981 position and now recommends cancellation of the contract and termination of the procurement. We are now a year downstream, having purchased and leased computers for this program.

Over $13 million has been committed, most of which would be lost. Moreover, we cannot realize the benefits of our ASAS system without the appropriate computers. To the same extent that our total ASAS capability is threatened, so too are the data systems which are planned to reside on that system—this, of course, includes the SDR system. After originally gaining GAO concurrence, if we are now forced to cancel the effort, the safety system will encounter at least a 2-year delay—and if a total new competition is directed, we are probably facing a 4-year delay.

I genuinely believe this will have a severe adverse effect on aviation safety. I have been so concerned that I have had personal discussions with several GAO offices about the reversed decision, and am hopeful we will get an early acceptance to continue our previously planned and approved program.

I would like to take this opportunity to seek the support of the committee for the full implementation of our ASAS system, including acquisition of the computer system.

That concludes my prepared statement, Mr. Chairman. At this time, I would like to turn to Craig Beard to give you a more detailed briefing on our current SDR program, and subsequently a detailed review by Dr. Fromme of our new ASAS program, which will go considerably beyond the NTSB recommendations.

Mr. Beard?

Mr. BEARD. Thank you very much, Mr. Administrator.

Mr. Chairman, I have a series of charts that repeat each other, and they slowly build so you can gain the full picture.

Probably the first set of reports that I would like to discuss are those that were received from the manufacturer. These are required by regulation. The manufacturers receive a lot of feedback

on the operational health of the fleets they have designed, and when they receive a report that they assess as being a safety-related report, either in the design of the aircraft or in the quality control system applied in the manufacture of the aircraft, they are required to report that to the FAA. That is reported directly to the aircraft engineering organization, or quality control organization that has responsibility for the aircraft.

Those are generally handled by telephone; however, they can be done by letter. Generally, a system is set up between the FAA and the particular manufacturer. Next chart, please.

Building on the same chart, then, we also receive the mechanical reliability reports from the air carriers. These are required by FAR 121 and 135. This is the list of the 16 items. The regulations also require the air carriers to report any other item that they consider to be significant to safety. So the first level of assessment on the consequences of any event rests with the carrier as they see them occur.

In addition to the list of 16, they are required to report to us anything of significance that might affect safety. These data go directly to the district office where the principal maintenance inspector resides. He reviews these reports and he mails them to the safety data branch in Oklahoma City where we do have a very old-fashioned automated data processing system. It goes into the system there. The reports are then forwarded on to the aircraft engineering office responsible for resolution of those comments.

It might be well to point out at this time that I am speaking to our routine system. A little bit farther on, we do have a system for handling urgent reports. It is a very effective system. Next chart, please.

In addition to the individual items that must be reported under the MRR system, we also have the mechanical interruption summary reports. These reports are also submitted to the district office. They are generally a lot more voluminous than the MRR reports. The principal maintenance inspector does review these as they come in. This is the system where we see the engine shutdowns. If the maintenance inspector sees engine shutdowns that he believes reflect a significant safety problem, he will then prepare the service difficulty report that does go to the data branch and feeds backup from the engineering office.

Mr. GLICKMAN. Let me just ask you a question. Will all engine shutdowns go through this system, or only those that the carrier believes jeopardize safety go through this system?

Mr. BEARD. I would say all engine shutdowns get into the system. They do not necessarily go beyond the principal FAA maintenance inspector, but they reach the FAA through that system.

Mr. HELMS. Let me clarify that, Mr. Chairman. The carrier has certain responsibilities, but there are separate reporting systems of service interruption difficulty. The distinction we are trying to establish is, I believe, the Chairman of the NTSB was referring to, that the carrier is responsible for, but the repair station has a reporting responsibility. So the repair station will fill out a form; it will come back and get in. It may not come from the carrier but it will get into the FAA system.

Mr. BEARD. If an engine is removed prematurely from the aircraft, it must be reported. Adding to the system from the red lines, you see other reports generated.

The FAR 145 operators, operators of large air carriers, these are the reports required of repair stations that do work on aircraft. Also, we have many, many voluntary reports coming from the general aviation community. In fact, about half of our reports do come in voluntarily from users of the product. These two are sent to the appropriate district office. They are reviewed, then passed on to the safety data branch, from there on up to engineering for a detailed assessment. Next chart.

In addition to that, our principal maintenance inspectors have a responsibility to track the carriers closely. If they see anything at all that they consider to be a significant or special safety problem, they are required to file a special report. These are reports written by FAA inspectors, and primarily they deal with the large high technology aircraft.

Those are not only sent to the safety data branch but they are sent to a regional office known as the Aircraft Evaluation Group. This is a group in the regional office comprised of operations and maintenance specialists that interface very closely with the type design, design approval engineers. Next chart, please.

I spoke of a system to handle urgent reports. When our district offices see any kind of report from any source, either something they have observed themselves or something that has been reported to them that they consider to be highly significant and urgent, they immediately place a phone call on our safety data branch. The safety data branch then loops into the net. The aircraft certification office is involved, manufacturers, other regional offices, operators involved, and they get to the bottom of it in a telephone conversation right then and there. Many significant reports are handled that way.

Last and certainly not least, we need to look at the product of this system. I would like to speak a little bit to the feedback to industry which is shown on the blue line dropping down to the box on the left-hand side. This feedback generally originates from the safety data branch. A lot of these numbers Mr. Helms has already referred to, but we have summarized them on the chart so you can see them.

The weekly summary of air carrier service difficulty reports, which is disseminated to all of the air carriers, all the reports received from the air carriers on the MRR system are repeated here and sent to the various other air carriers to look at. These are not screened out.

Mr. GLICKMAN. Just curiously, failure to put O-rings on engines, was that included in any of your weekly summaries or any of the materials sent out to carriers before the Eastern 1011 problem occurred?

Mr. HELMS. We have researched our files and we have no record of any kind that there has ever been an RB–211 engine failure due to leaving off the O-ring seals before that Eastern incident. We have had O-ring seals fail in flight. We have had, from other carriers—we have researched the records on other carriers—there is no record of any other carrier leaving off the O-ring seals.

Mr. GLICKMAN. There is no record of any other carrier? Is there any record of Eastern leaving off the O-ring before?

Mr. HELMS. We have no records in our files.

Mr. GLICKMAN. If I may go back to Mr. Burnett's statement—you were here—it says it was determined that there had been previous instances of oil starvation for the same reason involving this in other carriers. But on those occasions, only one of the three engines was affected and the oil-starved engine was shut down with inconsequential results.

What I am trying to get through with all these lines and graphs here is if, in fact, that occurred should that not have been perhaps on some bulletin that went out on the air carriers?

Mr. HELMS. There were records of a single engine not having an O-ring at Eastern. There were no records in any of our files of any other carrier ever having a shutdown due to lack of O-ring seals.

Mr. GLICKMAN. When did that last occur, that O-ring failure?

Mr. HELMS. Mr. Chairman, we are starting now to discuss items properly the role of the NTSB in consequentially determining the sequence of events. I believe we are going a little too far at this point.

Mr. GLICKMAN. OK. Let me ask you this, then: Is that not the kind of thing, an O-ring failure or failure to place it on there, that should be in one of these service bulletins that goes out to other carriers?

Mr. HELMS. There would certainly be—let me back up and start another way. An event similar to that should, in fact, without any question, be on it. You noted today and even in our statement we talked in terms of trends. The reason for wanting the large computers is we want an interactive system so that we do not depend solely on trends. With an interactive computer system you can take a single O-ring failure in a single engine in a single condition, using that, go into the data base and say have there been any under any conditions? You cannot do that today.

It is a very laborious system. If we went to batch processing—only we would not be able to do that. So we want an interactive system.

Under the ASAS system, the principal investigator could go in, sight a problem, type it in and through his terminal computer within 1 minute would know whether there has ever been any type of failure of a similar nature throughout the——

Mr. GLICKMAN. But on the current system, there seems to be a hole in the system by which something like this could have happened before, let's say failure to place O-rings on there, either by other carriers or Eastern or whomever. That may have not made it through the system so that it would be disseminated out there to warn other carriers to watch their maintenance people or make sure their vice president of maintenance is aware of this problem. That needs to be corrected very desperately.

Mr. HELMS. Yes, sir. That is the sole reason—I shouldn't say sole reason. It is the driving reason for ASAS, when the maintenance system was started some years ago and there were approximately 100 carriers—today there are over 400 trunk carriers, commuter carriers, and regional carriers. In addition, there is a proliferation of the different types of equipment. You just can't do it manually

any more, so we have to automate it. It is the only way we can do it.

Had we interrupted the ASAS program in an emergency 18-month effort to respond to NTSB, it would have taken our talent off the ASAS program and delayed ASAS. That is the reason I advise the chairman that the economic impact on the FAA in using that talent would have been a very, very poor management decision. We need to get ASAS going as rapidly as possible.

Mr. GLICKMAN. It wasn't economic impact on the carriers?

Mr. HELMS. We did not even consider that, Mr. Chairman.

Mr. GLICKMAN. You may proceed. I am sorry.

Mr. BEARD. Thank you very much, Mr. Chairman.

In the interest of time, I won't read each of the detailed charts. I believe you have heard the number before.

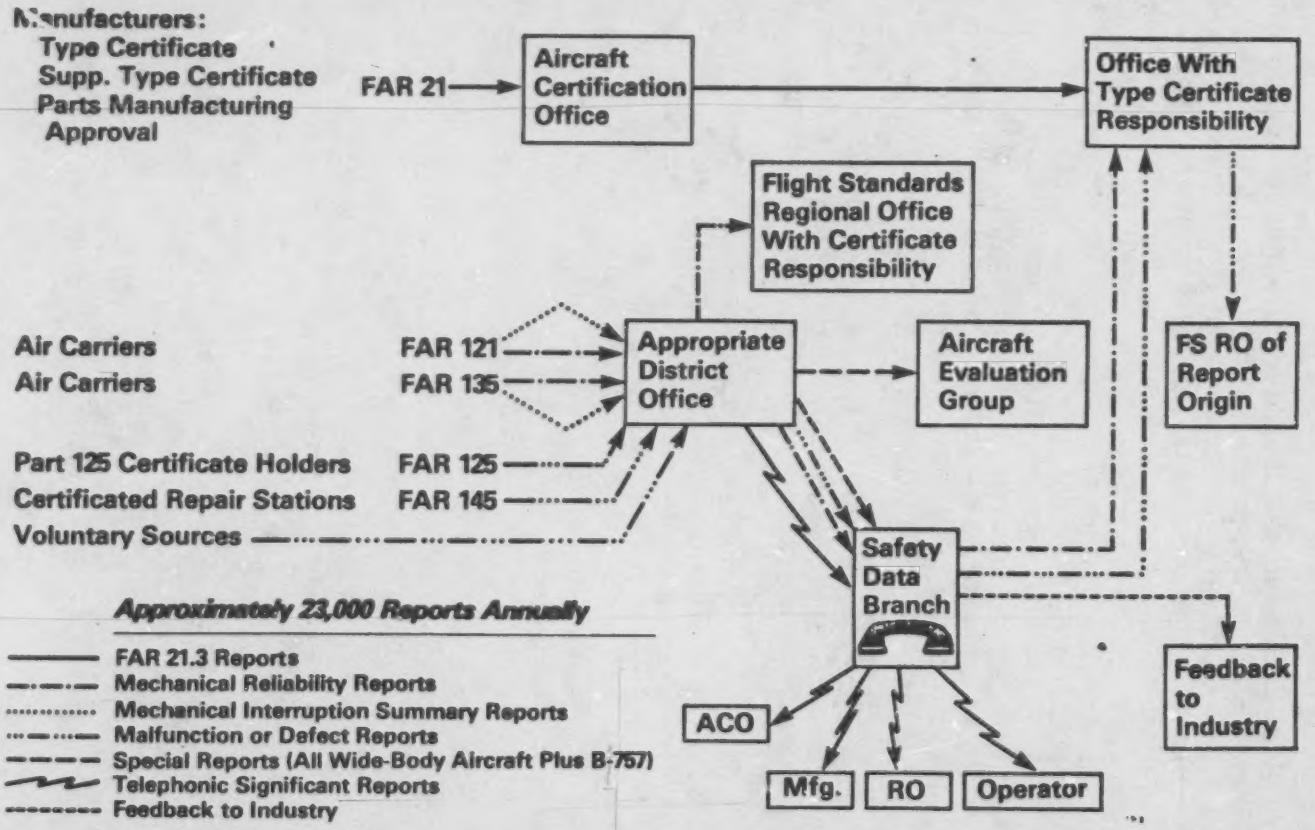
The chart on the far right-hand side, I believe, is significant. Airworthiness directives are directives we issue. They are regulations. They mandate corrective action. This might take on the form of design change in the aircraft. It might take on the form of special inspection or operating procedures. We do write many airworthiness directives as a result of the SDR program.

We also issue maintenance bulletins to our principal inspectors in the field. These are also made available to the public and are disseminated to the industry. These are two additional products we believe come from the SDR program and have a contribution to safety.

Thank you very much.

[Chart follows:]

Service Difficulty Report Requirements



Annual Feedback to Industry

- ***Weekly Summary of Air Carrier SDR's.***
  8,800 SDR's Sent to 4,500 Organizations, All FAA District Offices, and Interested Persons.
- ***Weekly Summary of General Aviation SDR's.***
  750 Selected SDR's Sent to 4,500 Organizations, All FAA District Offices, Interested Persons.
- ***Monthly Summary of Manufacturers SDR's.***
  4,000 SDR's Sent to 20 Manufacturers.
- ***Advisory Circular 43-16 General Aviation Airworthiness Alert.***
  750 Selected SDR's Sent to: 4,000 Repair Stations, 9,000 Authorized Inspectors, 150 Aviation Maintenance Technician Schools, 2,000 Requesting Mechanics, and All FAA District Offices.
- ***System Analysis Summary Reports.***
  40 SAS Reports of Adverse Trends in Aviation Products Sent to FAA Aircraft Certification Offices.
- ***Direct Access to SDR's.***
  Five Years of Data in 120,000 SDR's is Available for Direct Access by FAA and Aviation Industry with Computer Capability.
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  All SDR's are Available on Request from the FAA and At Least Three Commercial Sources.

Annual Feedback to Industry
(cont'd)

- ***Airworthiness Directives.***

  300 Airworthiness Directives (AD's) Sent Directly to All Aircraft Owners and Operators. All AD's Published in Annual Summary with Bi-Weekly Supplements. All AD's Available on Subscription.

- ***Maintenance Bulletins.***

  50 Maintenance Bulletins Sent to All FAA District Offices for Distribution to Industry.

Mr. HELMS. With the Chairman's permission, to show the comparison, we will switch over to the ASAS system and perhaps the comparison of the two will allow the committee members to ask questions relating to the new system compared to the old, so that you will be able to see some of those changes.

Dr. William Fromme, Director of Aviation Safety Office, will give the summary briefing.

Bill, hit all the points but let's try to do it as rapidly as possible.

Dr. FROMME. Thank you, Mr. Helms, Mr. Chairman.

I would like to continue the discussion if I could of the service difficulty reports and FAA airworthiness status system. The Administrator and Mr. Beard have explained the current system including regulatory environment, kinds of data collected currently, and data collection and application process.

As Mr. Beard pointed out, opportunities do exist for the improvement of our airworthiness data system. As a matter of fact, the need for fast, reliable information about safety activities is one that has concerned the FAA for many years. Much of our aviation safety data is maintained in manual or in compatible computer-based systems. Typically, it is difficult to retrieve and analyze information and draw conclusive results. Thus, maximum utilization of safety information often is not accomplished.

Delays in obtaining information can affect the FAA's ability to quickly analyze safety problems. Increased work load has added to the information overload. To meet the need for more accurate and timely safety information and to enhance our ability to more effectively identify potential safety problems, a plan has been devised to collect, store, and organize information into a single system that will enable the FAA to conduct accurate, timely analysis of aircraft airworthiness and other safety data. This plan is called the aviation safety analysis system, or ASAS.

The ASAS system evolved as a result of years of planning and innovation by the Federal Aviation Administration. Since the late 1970's, four major Federal studies have been conducted, numerous in-house evaluations have been made, FAA industry conferences held and studies of feasibility of automation have been performed. For example, in December 1979, the National Research Counsel was requested by the Secretary of Transportation to establish a blue ribbon committee to assess the adequacy of the FAA's policies and procedures for certifying the airworthiness of commercial aircraft. The blue ribbon committee report recommended "that the FAA increase its surveillance of airline maintenance operations and that the FAA accelerate its development of an effective information development and gathering system."

Also, at the request of the chairman of the House Committee on Public Works and Transportation, Congressman Levitas, GAO was asked to review the FAA's ability to deal with safety hazards. In its February 1980 report, the GAO recommended "improvement of the FAA's indentification." Conceptually, ASAS can be viewed as an umbrella under which pertinent aviation safety and certification data will be housed. It includes the necessary hardware, computers, terminals, word processors, et cetera, retrieval and analytical software programs, communication linkages, and as many as 40 aircraft data bases.

The SDR system, which was discussed by the Administrator and Mr. Beard, is but one essential element of the overall ASAS plan. Some of the other major ASAS systems include, first, the accident and incident system, which contains pertinent safety information relative to general aviation and air carrier accidents and incidents. This system currently contains more than 40,000 records.

We are working at present with the NTSB to consolidate accident and incident information from both organizations into one common data base system which will be part of the ASAS system. The enforcement information system is also part of ASAS. The system contains information pertaining to violations of the Federal aviation regulations and the enforcement action taken as a result of each violation. The system is currently being updated to incorporate results obtained from a yearlong field test in our southern region prior to final implementation in January 1984.

The third system under ASAS is our automated support to aviation regulations. This system will contain all Federal aviation regulatory research such as docket material, notices of proposed rulemaking, legal opinions, final rules and preambles, advisory circulars, directives, exemptions, and so forth. The initial planning phase of this system was completed in April 1983. Implementation of this automated system is scheduled to be completed by the end of calendar year 1985.

The next ASAS system is our certification system, which will contain a number of individual systems to support the certification and airworthiness activities of our four certification directorates.

Mr. GLICKMAN. Mr. Helms, if I may interrupt——

Mr. HELMS. Yes, sir.

Mr. GLICKMAN. Is this in prepared testimony that we might have for the record?

Mr. HELMS. Yes, sir. I am sure we can furnish it, Mr. Chairman.

Mr. GLICKMAN. Because what I would like to do is ask you a couple of questions regarding this without the necessity of hearing all the details about it.

Mr. HELMS. We will furnish that for the record with the chairman's concurrence.

[The prepared statement of Dr. Fromme follows:]

STATEMENT OF DR. WILLIAM R. FROMME,

DIRECTOR, FAA OFFICE OF AVIATION SAFETY, BEFORE

THE SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS

June 27, 1983

GOOD MORNING. MY NAME IS WILLIAM FROMME AND I AM THE DIRECTOR OF FAA'S OFFICE OF AVIATION SAFETY.

I WOULD LIKE TO CONTINUE THE DISCUSSION OF THE FAA'S AIRWORTHINESS DATA SYSTEM. MR. BEARD HAS EXPLAINED THE CURRENT SYSTEM INCLUDING: THE STATUTORY ENVIRONMENT; THE KINDS OF DATA CURRENTLY COLLECTED; AND THE DATA COLLECTION AND APPLICATION PROCESSES.

AS MR. BEARD POINTED OUT, OPPORTUNITIES EXIST FOR THE IMPROVEMENT OF OUR AIRWORTHINESS DATA SYSTEM. AS A MATTER OF FACT, THE NEED FOR FAST AND RELIABLE INFORMATION ABOUT SAFETY ACTIVITIES IS ONE THAT HAS CONCERNED THE FAA FOR MANY YEARS. DATA IS OFTEN MAINTAINED IN MANUAL OR INCOMPATIBLE COMPUTER-BASED SYSTEMS. TYPICALLY, IT IS DIFFICULT TO RETRIEVE AND ANALYZE INFORMATION AND DRAW CONCLUSIVE RESULTS. THUS, MAXIMUM UTILIZATION OF INFORMATION IS NOT REALIZED. DELAYS IN OBTAINING INFORMATION CAN AFFECT THE FAA'S ABILITY TO QUICKLY ANALYZE SAFETY PROBLEMS. INCREASED WORKLOAD AND DECLINING STAFFING AUTHORIZATIONS HAVE ADDED TO THE INFORMATION OVERLOAD AND HAVE DECREASED PRODUCTIVITY LEVELS. TO MEET THE EVER INCREASING NEED FOR MORE ACCURATE AND TIMELY SAFETY INFORMATION AND TO ENHANCE OUR ABILITY TO MORE EFFECTIVELY IDENTIFY POTENTIAL SAFETY PROBLEMS, A PLAN HAS BEEN DEVISED TO COLLECT, STORE, AND ORGANIZE INFORMATION INTO A SINGLE SYSTEM THAT WILL ENABLE THE FAA TO

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CONDUCT ACCURATE AND TIMELY ANALYSIS OF AIRCRAFT AIRWORTHINESS AND OTHER SAFETY DATA. THIS PLAN IS CALLED ASAS; THE AVIATION SAFETY ANALYSIS SYSTEM.

THIS SYSTEM EVOLVED AS THE RESULT OF YEARS OF PLANNING AND INNOVATION BY THE FEDERAL AVIATION ADMINISTRATION. SINCE THE MID-1970'S FOUR MAJOR FEDERAL STUDIES HAVE BEEN CONDUCTED, NUMEROUS IN-HOUSE EVALUATIONS HAVE BEEN MADE, FAA-INDUSTRY CONFERENCES HAVE BEEN HELD, AND STUDIES ON THE FEASIBILITY OF AUTOMATION HAVE BEEN PERFORMED.

1. IN DECEMBER 1979 THE NATIONAL RESEARCH COUNCIL WAS REQUESTED BY THE SECRETARY OF TRANSPORTATION TO ESTABLISH A "BLUE RIBBON" COMMITTEE TO ASSESS THE ADEQUACY OF THE FAA'S POLICIES AND PROCEDURES FOR CERTIFYING THE AIRWORTHINESS OF COMMERCIAL AIRCRAFT. THE BLUE RIBBON COMMITTEE REPORT RECOMMENDED:

   ". . . THAT THE FAA INCREASE ITS SURVEILLANCE OF AIRLINE MAINTENANCE OPERATIONS . . ." AND THAT, ". . . THE FAA ACCELERATE ITS DEVELOPMENT OF AN EFFECTIVE INFORMATION-GATHERING AND DATA SYSTEM."

2. IN 1979 A NATIONWIDE EVALUATION OF THE FAA FIELD AND HEADQUARTERS' PERSONNEL WAS CONDUCTED TO IDENTIFY THE CURRENT PRACTICES AND NEEDS RELATIVE TO A NEW SAFETY ANALYSIS SYSTEM. BASED UPON THE EVALUATION, WORK WAS BEGUN IN 1980 TO MEET THE FAA'S INFORMATION REQUIREMENTS.

3. AT THE REQUEST OF THE CHAIRMAN OF THE HOUSE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION AND CONGRESSMAN ELLIOTT H. LEVITAS, THE GENERAL ACCOUNTING OFFICE WAS ASKED TO REVIEW THE FAA'S ABILITY TO DEAL WITH SAFETY HAZARDS. IN ITS FEBRUARY 1980 REPORT, THE GAO RECOMMENDED:

IMPROVEMENT OF THE FAA'S IDENTIFICATION, COLLECTION, AND ANALYSIS OF SAFETY HAZARDS.

4. THE JULY 1981 REPORT OF THE PRESIDENT'S TASK FORCE ON AIRCRAFT CREW COMPLEMENT RECOMMENDED THE FOLLOWING:

   "THE SECRETARY OF TRANSPORTATION SHOULD TAKE STEPS TO EXPEDITE THE IMPLEMENTATION OF FAA'S PROGRAM (ASAS) TO STRENGTHEN ITS ABILITY TO COLLECT, PROCESS, AND DISSEMINATE SAFETY-RELATED INFORMATION NECESSARY FOR DECISIONMAKING IN FAA AND THE AVIATION INDUSTRY GENERALLY."

CONCEPTUALLY, ASAS CAN BE VIEWED AS A LARGE UMBRELLA UNDER WHICH ALL THE PERTINENT AVIATION SAFETY AND CERTIFICATION DATA WILL BE HOUSED. IT ALSO INCLUDES THE NECESSARY HARDWARE (COMPUTERS, TERMINALS, WORD PROCESSORS, ETC.), RETRIEVAL AND ANALYTICAL SOFTWARE PROGRAMS, COMMUNICATION LINKAGES, AS WELL AS NUMEROUS DATA BASES. THE SDR DATA SYSTEM, WHICH WAS DISCUSSED BY MR. BEARD, IS BUT ONE ESSENTIAL ELEMENT OF THE OVERALL ASAS PLAN. SOME OF THE OTHER MAJOR ELEMENTS ARE:

1. ACCIDENT AND INCIDENTS. THIS SYSTEM CONTAINS PERTINENT SAFETY INFORMATION RELATIVE TO GENERAL AVIATION AND AIR CARRIER ACCIDENTS AND INCIDENTS. THIS SYSTEM CURRENTLY CONTAINS MORE THAN 40,000 RECORDS. REQUIREMENTS ANALYSES AND SYSTEM SPECIFICATIONS ARE SCHEDULED TO BE COMPLETED DURING THIS CALENDAR YEAR.
2. ENFORCEMENT INFORMATION. THIS SYSTEM CONTAINS INFORMATION PERTAINING TO VIOLATIONS OF THE FEDERAL AIR REGULATIONS AND THE ENFORCEMENT ACTION THAT WAS TAKEN AS A RESULT OF THE VIOLATION. THIS SYSTEM IS CURRENTLY BEING UPDATED TO INCORPORATE RESULTS OBTAINED FROM FIELD TESTING PRIOR TO FINAL IMPLEMENTATION WHICH IS SCHEDULED FOR JANUARY 1984.

3. AUTOMATED SUPPORT TO AVIATION REGULATIONS. THIS SYSTEM WILL CONTAIN ALL FEDERAL AVIATION REGULATORY INFORMATION SUCH AS DOCKET MATERIAL, NPRM'S, LEGAL OPINIONS, FINAL RULES AND PREAMBLES, ADVISORY CIRCULARS, DIRECTIVES, EXEMPTIONS, HANDBOOKS, TECHNICAL REPORTS, AND REGULATORY HISTORY. THE INITIAL PLANNING PHASE OF THIS SYSTEM WAS COMPLETED IN APRIL 1983. IMPLEMENTATION OF THIS SYSTEM IS SCHEDULED TO BE COMPLETED BY THE END OF CY 1985.

4. AIRWORTHINESS DATA. THIS DATA SYSTEM WILL CONTAIN A NUMBER OF INDIVIDUAL SYSTEMS TO SUPPORT THE CERTIFICATION AND AIRWORTHINESS ACTIVITIES OF THE FOUR (4) CERTIFICATION DIRECTORATES. THESE TYPE OF DATA INCLUDE: TECHNICAL STANDARD ORDERS, AIRWORTHINESS DIRECTIVES, TYPE CERTIFICATION DATA SHEETS, PARTS MANUFACTURE APPROVALS, AIRWORTHINESS REGULATIONS, AIR AGENCIES, AIR OPERATORS, AIRCRAFT PRODUCT MANUFACTURERS, AND POLICY AND GUIDANCE INFORMATION FOR CERTIFICATION ACTIVITIES. THIS SYSTEM WILL ALSO INCLUDE A PROJECT TRACKING AND STATUS SYSTEM COVERING ALL CERTIFICATION ACTIVITIES BOTH BY INDIVIDUAL DIRECTORATE OR ON A NATIONAL BASIS. THE DEVELOPMENT OF USER REQUIREMENTS, SCHEDULED TO BE COMPLETED THIS FALL, IS WELL UNDERWAY. FINAL IMPLEMENTATION IS PROGRAMMED TO BE COMPLETED BY THE END OF 1985.

5. AIR CARRIER UTILIZATION. THIS SYSTEM WILL PROVIDE COMPUTERIZED STORAGE, RETRIEVAL, AND TRACKING OF INFORMATION ON ALL AIRCRAFT OPERATING UNDER FEDERAL AVIATION REGULATIONS PARTS 121 AND 135 REGARDING AIRCRAFT UTILIZATION, MAINTENANCE, AND PROPULSION RELIABILITY AND AIR CARRIER OPERATOR DATA. REQUIREMENTS ANALYSES AND SYSTEM SPECIFICATIONS ARE SCHEDULED TO BE COMPLETED BY 1983. FINAL IMPLEMENTATION IS SCHEDULED TO BE COMPLETED BY THE END OF 1984.

6. AVIATION SECURITY. THIS SYSTEM WILL INCLUDE DATA PERTAINING TO HAZARDOUS MATERIALS, HIJACKING, SABOTAGE, AIR CARRIER STATION INSPECTIONS, AIRPORT INSPECTIONS, K-9 ACTIVITY, SCREENING ACTIVITIES, SECURITY ALERTS, BULLETINS, SUMMARIES, PHYSICAL SECURITY AND INTERNAL INVESTIGATIVE INFORMATION. THIS SYSTEM IS SCHEDULED TO BE IMPLEMENTED BY THE END OF 1985.

7. SAFETY ANALYSIS. THIS SYSTEM WILL ENCOMPASS A SERIES OF SPECIALLY DESIGNED SOFTWARE PROGRAMS WHICH WILL ENHANCE THE IDENTIFICATION AND ANALYSES OF POTENTIAL SAFETY ISSUES. THE TASK OF DEFINING THE TYPES OF ANALYSES NECESSARY TO PROVIDE THIS CAPABILITY, WHICH IS SCHEDULED TO BE COMPLETED AT THE END OF THIS SUMMER, IS ON SCHEDULE. THE DEVELOPMENT AND IMPLEMENTATION OF ALL OF THE SOFTWARE PROGRAMS ARE SCHEDULED TO BE COMPLETED IN THE FALL OF 1984.

8. FIELD OFFICE MODERNIZATION PROGRAM. THIS PROGRAM IS AN INTEGRAL COMPONENT OF ASAS WHICH WILL PROVIDE THE MORE THAN 160 DISTRICT OFFICES WITH THE EQUIPMENT NECESSARY TO RECEIVE, RECORD, TRANSMIT, DISTRIBUTE, AND PROCESS TECHNICAL INFORMATION. THE MAJOR GOAL OF THIS PROGRAM IS TO IMPROVE THE EFFICIENCY AND EFFECTIVENESS OF THE FLIGHT STANDARDS AND CIVIL AVIATION SECURITY FIELD OFFICES BY RELIEVING THE INSPECTORS FROM BURDENSOME PAPERWORK AND PROVIDING MANAGEMENT WITH MORE DATA UPON WHICH TO BASE IMPORTANT DECISIONS. THE DICTATION AND TRANSCRIBING EQUIPMENT DELIVERY SCHEDULE WAS COMPLETED IN 1982. IT IS ESTIMATED THAT 309 BURROUGHS INFORMATION PROCESSING UNITS WILL BE DELIVERED TO ALL OF THE SITES BY THE END OF CALENDAR YEAR 1984.

HOW ASAS IS ORGANIZED:

THE ASAS COMMUNICATION NETWORK (FIGURE 1) DIAGRAMS THE PATTERNS OF COMMUNICATIONS THAT WILL LINK THE FAA'S GEOGRAPHICALLY DISPERSED OFFICES. EACH

DISTRICT OFFICE WILL BE CONNECTED THROUGH ITS REGIONAL OFFICE TO OUR MAIN FRAME COMPUTER IN OKLAHOMA CITY. WASHINGTON HEADQUARTERS AND ALL REGIONAL OFFICES WILL HAVE DIRECT LINKS TO OKLAHOMA CITY.

THE NATIONAL PERSPECTIVE OF THE AVIATION SAFETY ANALYSIS SYSTEM IS DISPLAYED IN FIGURE 2. NINE LOCATIONS HAVE BEEN CITED FOR PROCUREMENT OF THE DATA GENERAL ECLIPSE MV8000 COMPUTERS. THESE LOCATIONS ARE:

FAA HEADQUARTERS, WASHINGTON, D.C.

FAA TECHNICAL CENTER, ATLANTIC CITY, N.J.

AERONAUTICAL CENTER, OKLAHOMA CITY, OKLAHOMA

ALASKAN REGION

CENTRAL REGION

EASTERN REGION

SOUTHERN REGION

SOUTHWEST REGION

WESTERN-PACIFIC REGION

DELIVERY HAS BEEN COMPLETED AT ALL NINE LOCATIONS. EIGHT OF THE NINE LOCATIONS HAVE COMPLETED ACCEPTANCE TESTING. THE REMAINING REGION (ALASKA) IS CURRENTLY UNDERGOING FINAL ACCEPTANCE TESTING.

A TYPICAL REGIONAL ASAS CONFIGURATION IS SHOWN IN FIGURE 3. EACH OF THE DISTRICT OFFICES SHOWN HERE WILL RECEIVE BURROUGHS B20 MICRO COMPUTER TERMINALS.

BY YEAR END 1984, EACH DISTRICT OFFICE WILL HAVE INFORMATION PROCESSING EQUIPMENT CONTAINING A CENTRAL PROCESSING UNIT AND SOME FORM OF MASS STORAGE WHICH WILL ALLOW IT TO INPUT, STORE, RETRIEVE, AND PRINT ALL AIRWORTHINESS DATA

AND OTHER INFORMATION NECESSARY TO PERFORM ITS DAILY ACTIVITIES. IT WILL ALSO HAVE A COMMUNICATION CAPABILITY TO ENABLE IT TO EXCHANGE INFORMATION WITH ITS REGIONAL OFFICE.

THE FAA HEADQUARTERS AND THE REGIONAL OFFICES WILL HAVE COMPUTER SYSTEMS TO PROVIDE THEM WITH THEIR OWN PROCESSING, STORING, AND COMMUNICATING CAPABILITIES. THE REGIONAL OFFICES WILL ALSO SERVICE THE COMMUNICATION NEEDS OF THEIR DISTRICT OFFICES.

OKLAHOMA CITY WILL BE THE SITE OF THE CENTRAL INFORMATION PROCESSING FACILITY FOR ASAS AND WILL BE THE RESIDENCE OF A LARGE "MAIN FRAME" COMPUTER AND ALL AVIATION AIRWORTHINESS BASES.

THERE ARE SEVERAL IMMEDIATE ASAS BENEFITS FROM OUR AVIATION AIRWORTHINESS INFORMATION SYSTEM. THESE INCLUDE:

1. COST EFFECTIVE DATA PROCESSING. DATA WILL BE ENTERED AT THE SOURCES(S) WHERE IT IS GENERATED AND TRANSMITTED ELECTRONICALLY TO THE CENTRAL DATA SYSTEM. THIS PROCESS WILL ELIMINATE THE NEED FOR MULTIPLE TYPING OF DATA WHICH WILL PROVIDE A MORE COST-EFFECTIVE APPROACH TO DATA PROCESSING.
2. DATA QUALITY. THE QUALITY OF DATA WILL BE ENHANCED THROUGH THE USE OF SPECIALLY DESIGNED EDIT ROUTINES. THESE EDIT FUNCTIONS WILL PROVIDE A DIRECT COMPARATIVE CHECK OF DATA TO ENSURE ACCURACY BEFORE IT IS ADDED TO THE DATA SYSTEM. THESE EDITING FUNCTIONS WILL BE PERFORMED ELECTRONICALLY.

3. TIMELY DATA. THE TRANSMISSIONS OF DATA BETWEEN ALL ENTRY SOURCES WILL BE ACCOMPLISHED ELECTRONICALLY INSTEAD OF USING THE PRESENT MAILING SYSTEM. THIS PROCESS WILL GREATLY IMPROVE THE TIMELINESS AND AVAILABILITY OF DATA.
4. ACCESSIBILITY AND DISTRIBUTION. ONE OF THE MAJOR THRUSTS OF ASAS IS TO INCREASE THE ACCESSIBILITY OF SERVICE DIFFICULTY DATA. THROUGH THE USE OF ASAS COMMUNICATIONS, ALL DISTRICT AND REGIONAL OFFICES WILL BE LINKED WITH EACH OTHER AND WITH HEADQUARTERS IN A MANNER THAT ALLOWS FOR NEAR REAL-TIME COMMUNICATION. THIS WILL CREATE AN ENVIRONMENT WHERE SERVICE DIFFICULTY REPORTS CAN BE AUTOMATICALLY CIRCULATED FOR REVIEW, COMMENT, AND ACTION THROUGHOUT THE SYSTEM. IN THIS MATTER, ALL INTERESTED PARTIES (DISTRICT OFFICES, CERTIFICATION DIRECTORATES, NATIONAL RESOURCE SPECIALISTS, AIRWORTHINESS ENGINEERS, ETC.) WILL HAVE IMMEDIATE ACCESS TO PERTINENT INFORMATION.
5. DATA SHARING WITH INDUSTRY. EVENTUALLY, OTHER NON-FAA PARTIES WILL GAIN ACCESS TO THIS ASAS SYSTEM. HERE (FIGURE 4) WE SEE HOW ASAS FACILITATES THIS FUTURE SDR SYSTEM NETWORK CONCEPT. WHEN THE SYSTEM IS FULLY OPERATIONAL, DATA SOURCES, EACH HAVING ACCESS TO A BURROUGHS B20 SYSTEM OR OTHER COMPATIBLE WORD PROCESSING/COMPUTER/TELECOMMUNICATIONS DEVICE, WILL TRANSMIT PERTINENT AIRWORTHINESS DATA INTO THE ASAS NETWORK. THE AVIATION SAFETY ANALYSIS SYSTEM WILL COMPILE DATA FROM ALL SOURCES AND MAKE IT AVAILABLE IN AN AGGREGATED FORM TO ALL DATA USERS.

TO THIS POINT, WE HAVE ONLY HAD LIMITED SUCCESS IN OBTAINING VOLUNTARY DATA FROM INDUSTRY. THERE ARE SEVERAL REASONS FOR THIS, INCLUDING CONCERNS BY INDUSTRY

ABOUT SHARING INFORMATION WHICH THEY CONSIDER PROPRIETARY. WE ARE MAKING PROGRESS SLOWLY IN THIS REGARD AND HOPE THAT ULTIMATELY THE ASAS CONCEPT WILL EMBRACE INDUSTRY SOURCES.

COUPLED WITH ASAS IMPLEMENTATION ARE PROGRAMMATIC CHANGES TO THE SDR SYSTEM. THIS EFFORT IS BEING LED BY CRAIG BEARD AND IS INTENDED TO IMPROVE THE UTILITY OF SDR DATA IN THE SYSTEM. A NUMBER OF BASIC QUESTIONS ARE BEING ADDRESSED, SUCH AS:

1. WHAT DO WE DO WITH DATA WHICH NOW RESIDE IN THE SYSTEM?
2. WHAT ADDITIONAL DATA DO WE NEED THAT WE DO NOT HAVE? AND,
3. WHAT DATA DO WE NOW COLLECT THAT WE DO NOT NEED?

IN ADDITION, IMPROVEMENT OF THE AUTOMATIC TREND EVALUATION OR ALERTING SYSTEM IS BEING CONSIDERED. WHILE THE SDR SYSTEM BY ITSELF IS A VALUABLE ANALYTICAL DEVICE, AN IMPROVED ALERTING ALGORITHM, COUPLED WITH THE SDR DATA BASE, WILL FOREWARN THE FAA, AIR CARRIERS, MANUFACTURERS, AND THE GENERAL PUBLIC OF POTENTIALLY HAZARDOUS DEVELOPMENTS OR EMERGING PROBLEMS. BASED UPON SUMMATIONS OF SDR REPORTS, NEGATIVE TRENDS ON A PARTICULAR AIRCRAFT PART OR COMPONENT WILL BE IDENTIFIED.

WE ENVISION A SYSTEM WHICH HAS BEEN PRECALIBRATED IN RELATION TO THE MOST CRITICAL AIRCRAFT COMPONENTS. THAT IS, THE SYSTEM WILL HAVE ALREADY BEEN "WEIGHTED" TO REFLECT THOSE PARTS OF THE AIRCRAFT, WHICH IF INOPERABLE, WOULD

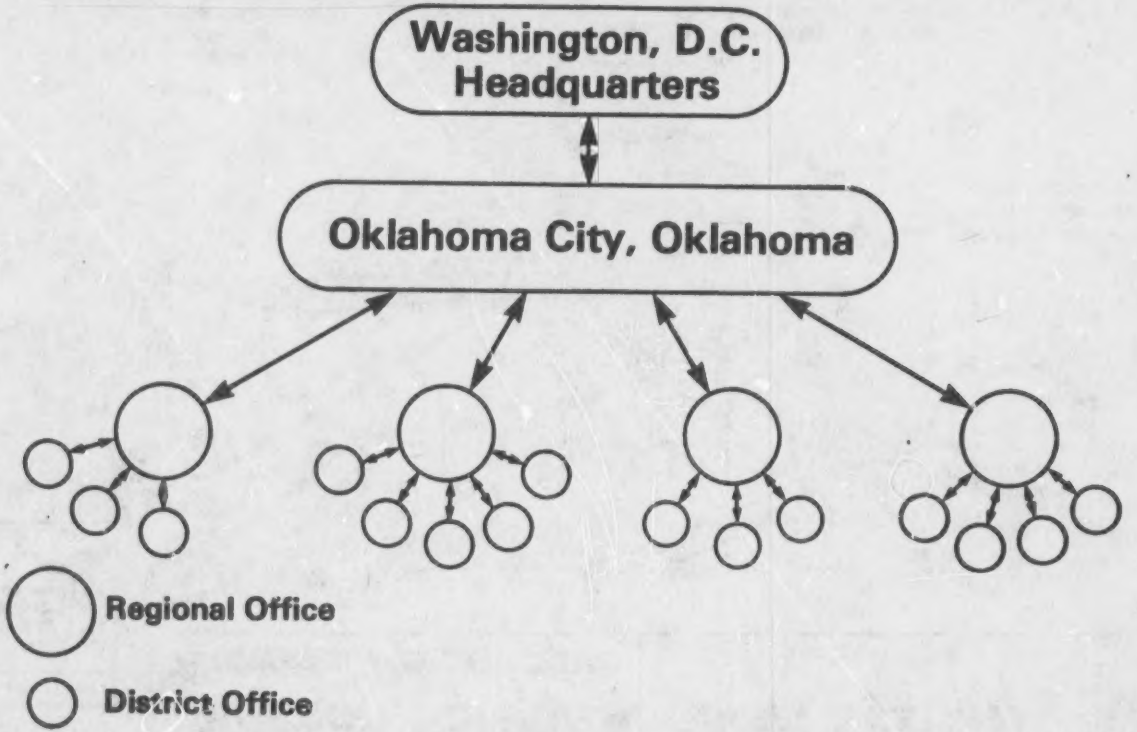
CAUSE THE GREATEST THREAT TO THE SAFETY OF THAT AIRCRAFT. BASED ON REAL-TIME SDR REPORTS, THE FREQUENCY OF BREAKDOWNS OF THESE CRITICAL COMPONENTS WILL AUTOMATICALLY BE MONITORED. WHEN FAILURES EXCEED ACCEPTABLE RATE LEVELS (BASED ON TOTAL FLEET EXPOSURE) IMMEDIATE REMEDIAL/PREVENTIVE ACTION WILL BE TAKEN.

THE SYSTEM WILL ALSO PROVIDE THE AWARENESS OF THESE UNSAFE TRENDS TO THOSE WHO NEED TO KNOW. IT WILL DISSEMINATE THE INFORMATION IN THE TERMS NEEDED BY THOSE INDIVIDUALS TO BE ABLE TO ASSESS THE SITUATION AND TAKE APPROPRIATE ACTION. IN SUMMARY, THIS AUTOMATED ALERTING SYSTEM WILL ALLOW FAA TO IDENTIFY UNSAFE TRENDS MORE QUICKLY THAN AT PRESENT; TO DESIGN ALTERNATIVE CORRECTIVE ACTION; ARRIVE AT A SPECIFIC CONCLUSION OR COURSE OF ACTION; AND INSTITUTE THAT COURSE.

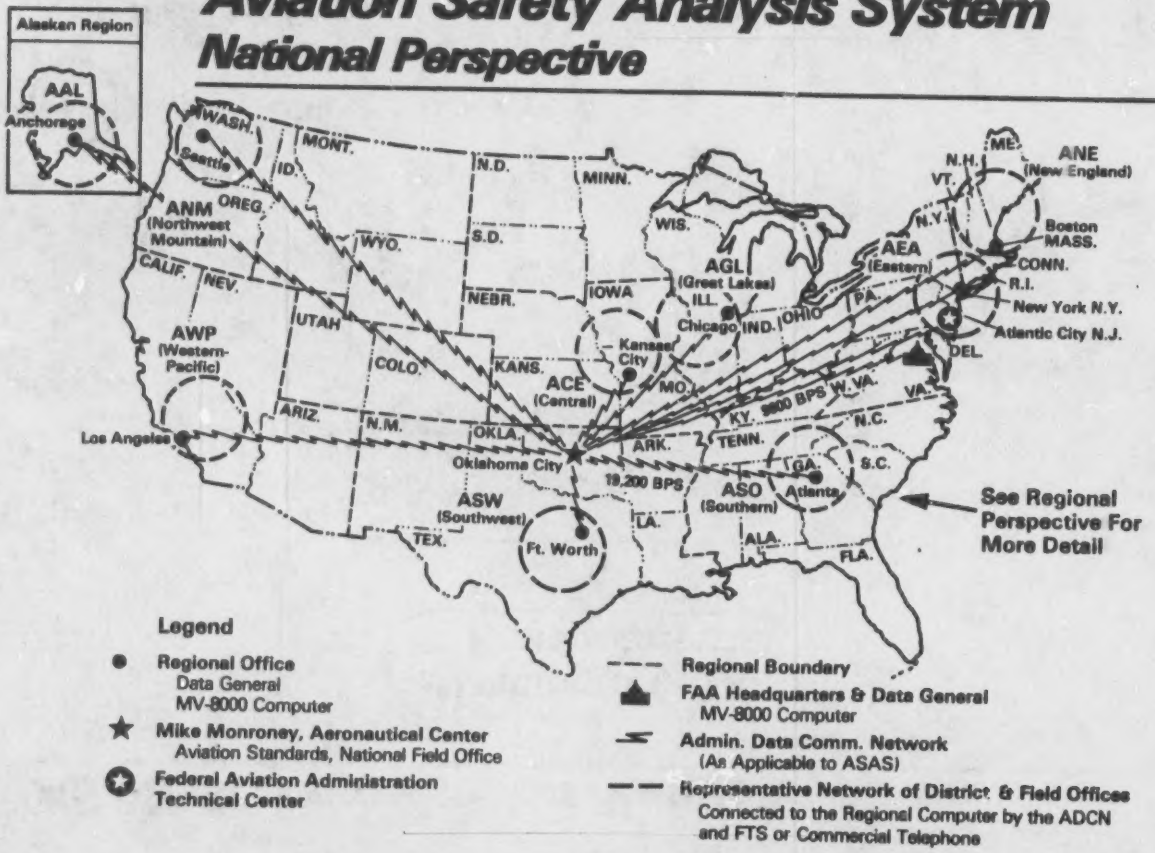
WE WILL MODIFY THE ASAS/SDR SYSTEM TO INCORPORATE RECOMMENDED CHANGES IN THE TYPES AND CONTENT OF THE DATA COLLECTED AND RETRIEVED, AS WELL AS CHANGES IN THE POINTS AT WHICH DATA ENTRIES AND RETRIEVALS ARE MADE. THUS, WE CAN EXPECT IMPROVEMENTS TO THE AIRWORTHINESS DATA SYSTEM - RESULTING FROM BOTH THESE EFFORTS.

THANK YOU FOR THE OPPORTUNITY TO MAKE THIS STATEMENT. I WILL BE HAPPY TO ANSWER ANY QUESTIONS YOU MAY HAVE.

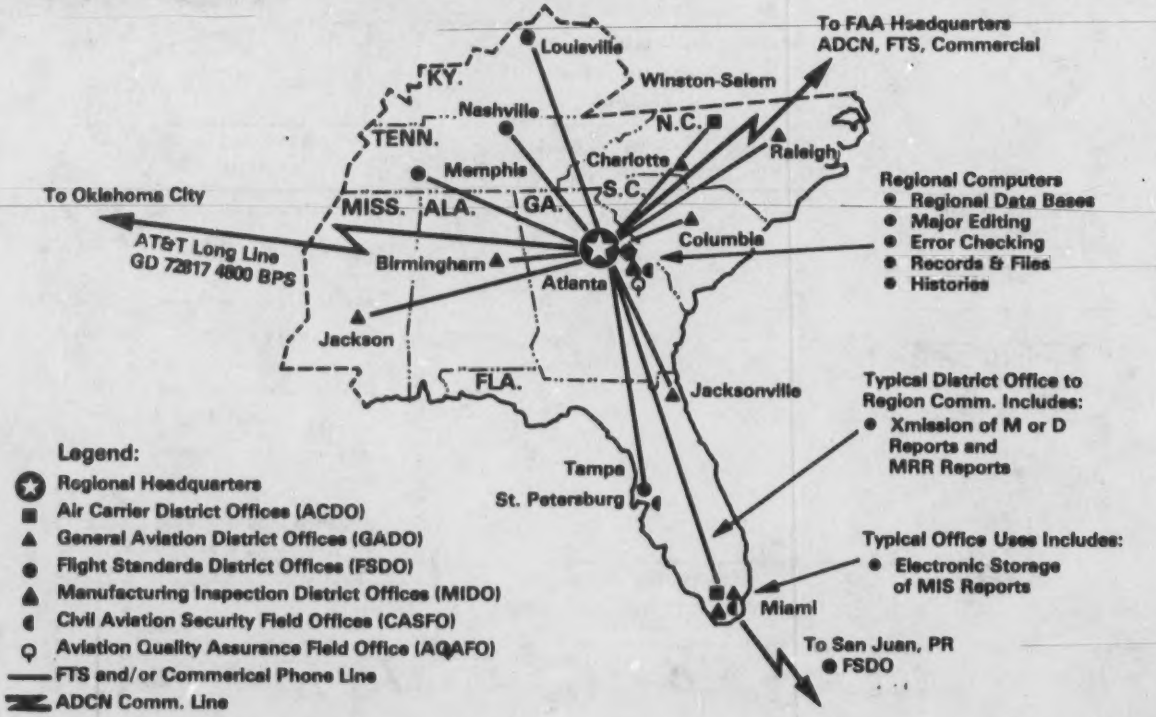
ASAS Communication Network



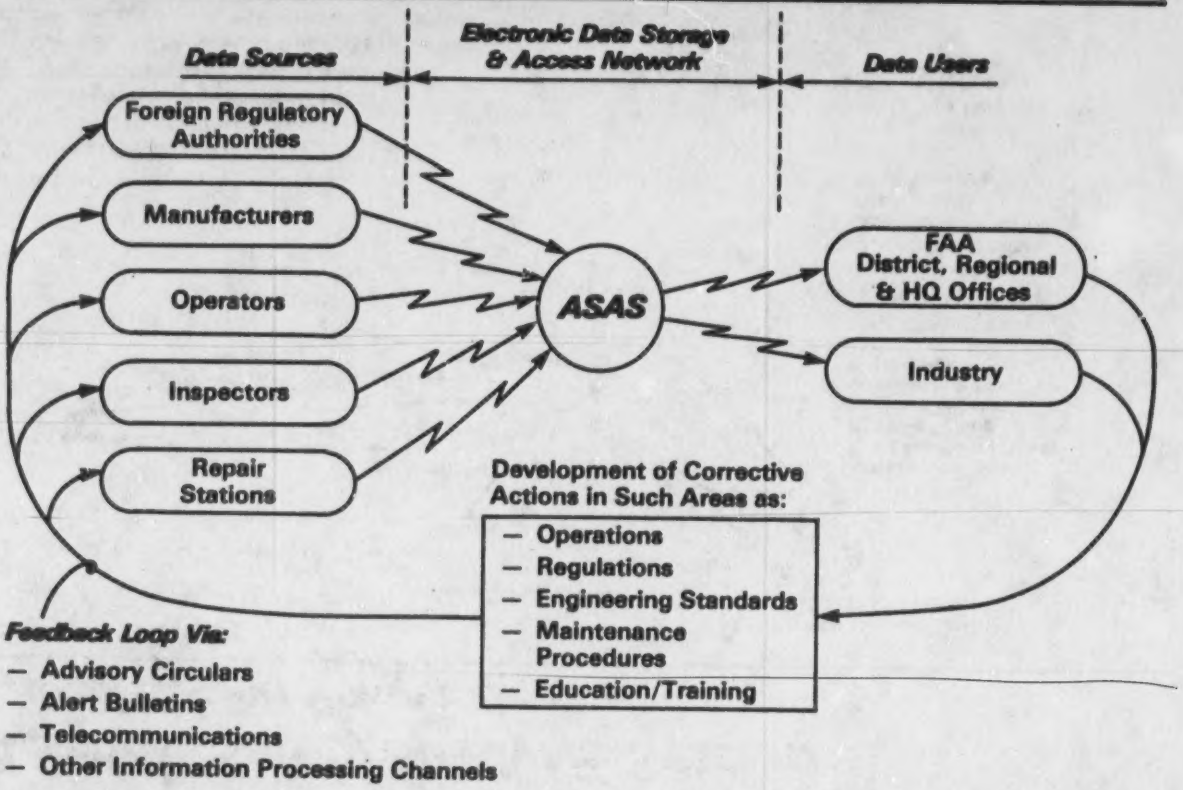
Aviation Safety Analysis System
National Perspective



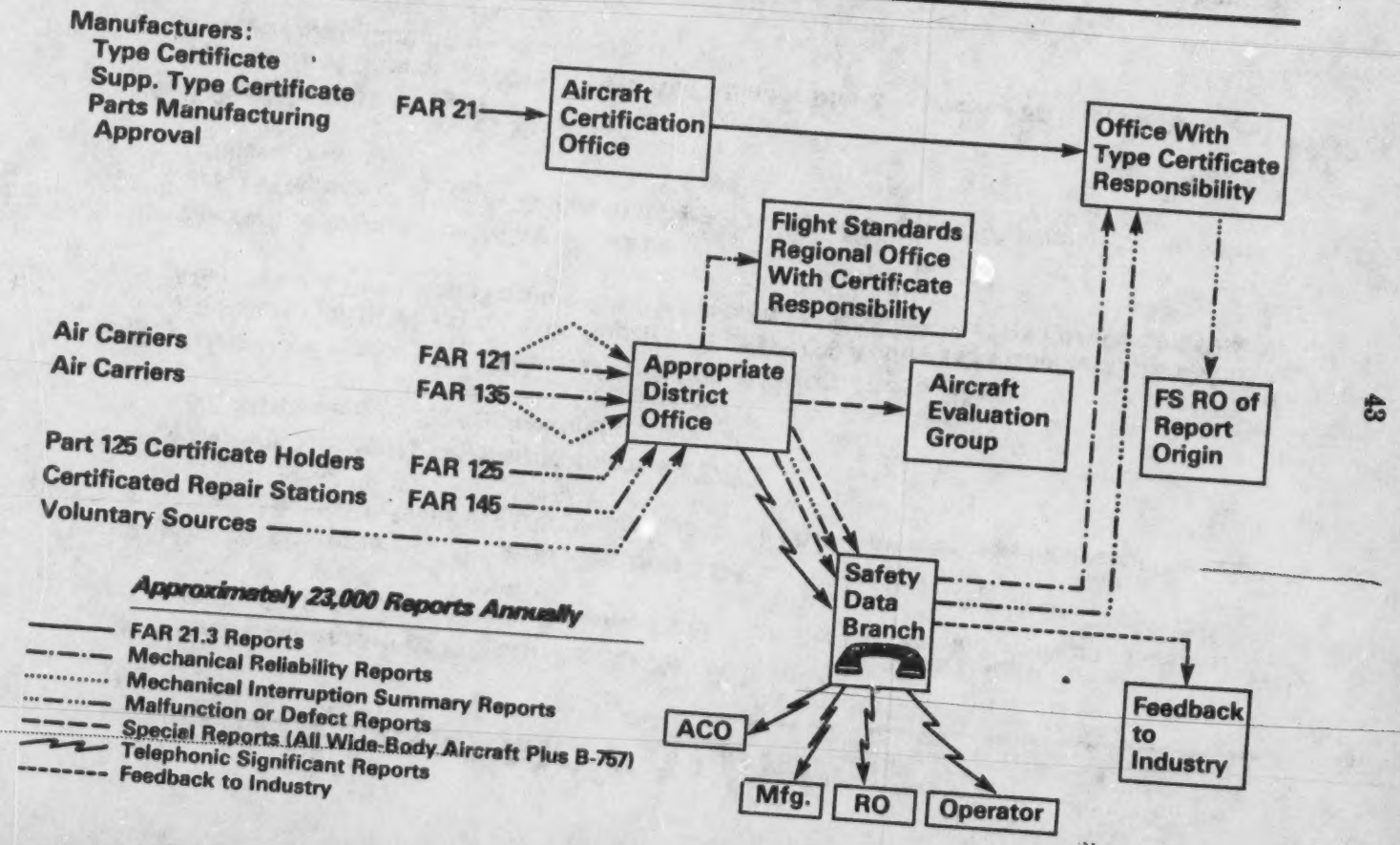
Aviation Safety Analysis System
Typical Region Perspective



Future SDR System Network Concept



Service Difficulty Report Requirements



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(cont'd)

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Mr. GLICKMAN. As you talked about the GAO's position, it reversed its position and recommends cancellation of the contract. Why?

Mr. HELMS. As I understand it—and I must emphasize that the GAO should have the opportunity to speak for themselves—as I understand, there was a subsequent request by the vendor that again raised the question about the competition. The issue was raised again and reversed by GAO. But I raise again that is a question that should be raised with GAO.

Mr. GLICKMAN. In the appropriations bill, the regional computer system was not included for funding.

Mr. HELMS. And because of that GAO report. That is why I became so alarmed that I went to personally visit senior officials of GAO and pointed out they were now affecting aviation safety, and I couldn't——

Mr. GLICKMAN. If you don't get the money, you don't get an ASAS system.

Mr. HELMS. Precisely.

Mr. GLICKMAN. You will be stuck with the current reporting system.

Mr. HELMS. Yes, sir. That is correct.

Mr. GLICKMAN. It could set you back a few years.

Mr. HELMS. At least 2 years, if we had to deal with even the present authority, but with a different computer. But if we had to have a whole new competition, it would be 4 years, Mr. Chairman.

Mr. GLICKMAN. Who was the vendor that the contract was issued to originally?

Mr. HELMS. In this particular case, we have a contract with Data General. There was a vendor, Four Days, that took exception to the award. They are the one that filed the protest. We have furnished additional information, however, to GAO. I am very hopeful that they will reconsider on the basis of the indepth analysis we went through before making the award; that they will follow through with their original decision of July 1981.

Mr. GLICKMAN. Obviously, our concern is that if for some reason that doesn't happen up here or over at GAO, you are going to be stuck with patching your current system that you have.

Mr. HELMS. Yes, sir.

Pardon me. I said July 1981. It should have been 1982. Years go by too fast for me at times.

Mr. GLICKMAN. You are patching your current system, one which seems to have some holes in it. We will work with you on it.

Mr. HELMS. I am very concerned about this position, Mr. Chairman. There is no question it will have an impact on aviation safety. It was for that reason I felt I had to personally go to the senior officials at GAO and note this for them.

Mr. GLICKMAN. Did you have a question on this?

Mr. CARNEY. I do.

I am sympathetic with the problem that you are faced with, Mr. Helms. I certainly would like to see the information put together and disseminated in a better, more economical fashion, I am sure. But I have an overall question.

Whether you have the new ASAS system or you are back to the old system, would that have mattered to the fellow who forgot to

put the gas in the Republic airplane? He didn't put fuel in there. I mean, he doesn't need a system to tell him to put aviation fuel in his plane.

Mr. HELMS. I don't know yet whether NTSB has made the determination as to whether they will investigate that as an incident, Mr. Carney. So I have to be a little careful about what I do about commenting on it.

To the extent, however, that there is an approved operations manual which is followed, our inspectors are the ones that followup on that. To the extent perhaps that the system did not allow it, that is another item. But I have to be a little careful now. Once NTSB decides they wish to investigate an accident or incident, it is properly their prerogative to make comments about what they find.

Mr. CARNEY. Perhaps I am in the same area again. We go back to the O-rings. I would think every mechanic would recognize the importance of an O-ring. I don't think they need a bulletin that said Joe Smidlap didn't put an O-ring on yesterday.

Mr. HELMS. Let me use a parallel which I think will address your question.

Last Monday, in one of my normal jump seat flights on another carrier, I was in the jump seat. I wait to see if the captain gets his signoff and, in this case, the third officer, flight engineer, to see if he gets a signoff for fuel. That slip came in, was signed off, and down in the form it said zero fuel put aboard. This flight engineer handed it to the captain and said, "Captain, the gages show we have fuel but the dispatch office showed zero fuel put aboard." The captain said, "Then we are not going to leave." The flight was delayed 7 minutes while the dispatcher came out, noted that they had in fact put fuel aboard, rechecked the tabulation on the fuel truck to make absolutely certain.

So the system is self-checking, Mr. Carney. It does work when everybody does their job right and people follow it.

Mr. CARNEY. I agree. But this wasn't the cause for that captain to delay the flight 7 minutes. What caused that captain to delay the flight 7 minutes was good judgment. That is what it was. As the captain of that plane, he saw a discrepancy. He made the judgment. It was a good judgment call not to takeoff.

Mr. HELMS. That, plus his operations manual——

Mr. CARNEY. Another captain might have said, "Hey, listen, we have it. The gages say we have it." We don't know. It is speculative on my part. I am just saying it seems to me that it gets so complex. We have the ability to get so much data. And, again, I would prefer to have the data and a new system where it is perhaps easier to analyze, easier to disseminate to those who are in need of it. But when you have so much data you wonder just how effective it is.

How do we correct the problem of a fellow not putting the O-rings on? It is not the data. He has to know, if he is a licensed FAA mechanic, the importance of an O-ring. All the data in the world wouldn't teach him any more about that importance.

Mr. HELMS. That is correct. You are absolutely right.

Mr. CARNEY. It was an oversight not caused by the fact our data bank is behind in technology.

Mr. HELMS. That is correct. To the extent an individual does not fulfill his responsibilities and there is not an inspection system for every one of the potential millions of items that could be done, then we have a potential void.

Mr. CARNEY. Would we be better off looking into a better inspection system to insure that these human errors are not made?

Mr. HELMS. I doubt that it is humanly possible to inspect every potential. Rather, I think we would probably be better off going to better training systems to insure that all of the mechanics, the people involved in maintaining aircraft, are constantly trained and retrained and checked against that training. That is probably the better——

Mr. CARNEY. Again, I don't mean to trade off your information system; I am not saying that at all.

Mr. HELMS. I recognize that.

Mr. CARNEY. In fact, I am supportive of your efforts assuming there is no conflict with the purchase of the equipment, that everything is legal and above board and the bidding systems are proper. I certainly would say move forward so that you can better analyze the data and get the data out. That is beside the point.

Even with a better data system, we will still continue to have those factors that the data system will not effect. I am wondering how we get around that. Is it better inspection, better training, better morale? I don't know.

I don't see that this data system would have prevented that O-ring situation, nor would it prevent a situation where a pilot didn't have the required amount of fuel.

Mr. GLICKMAN. If I may interrupt, let me ask you this question in light of what Mr. Carney says. Do we have some carriers in this country who, because of financial problems, are not doing the job they should in the areas of airline maintenance and safety?

Mr. HELMS. I don't think we have any that are not following the book and doing absolutely everything that is required. However, we have significantly expanded our inspection over the last 18 months. We do point that inspection more at some carriers than others in recognition of perhaps their economic basis; yes, Mr. Chairman.

Mr. GLICKMAN. So, in fact, you are intensifying your efforts and looking at certain carriers that are having financial problems to insure that they are doing an appropriate inspection job?

Mr. HELMS. We have the same worries that everyone else has, and because of certain financial data that are made available to us working in conjunction with CAB, which is not available to the open public, we use that as one more input that tells us maybe we better be a little bit more persevering. So our scrutiny goes up; yes, sir.

Mr. GLICKMAN. I guess the heart of Mr. Carney's question is that, do all of the technological improvements on your ASAS system or other systems obscure the fact that in this day and age with deregulation, with a whole range of new carriers, with some airlines on the brink of bankruptcy—should the FAA be devoting more of its resources on training, inspection and perhaps pushing back some of its resources on hardware and software?

Mr. HELMS. I learned some years ago, Mr. Chairman, that management can plan to expect what it plans to inspect. It is just that

simple. So that supervision must improve within the carriers, and supervision within FAA is becoming more active. We are doing more inspection now than we did 2 years ago.

Since the strike, we have had over 19,000 flights by FAA inspectors in air carrier aircraft solely to make sure that the system is working.

Mr. GLICKMAN. Unannounced? Do you let them know you are on the airplane?

Mr. HELMS. We don't let them know until we walk aboard, sir.

Mr. CARNEY. I think the chairman summarized, except for one point, what I was thinking of, and perhaps did not make, clear. What I am afraid of is when we come out with this new program—and, again, I must emphasize I support the new program——

Mr. HELMS. I recognize the distinction.

Mr. CARNEY [continuing]. But when we come out with the new programs, do we get a false sense of security because we have a better information system? Obviously, the gentleman detailed the first system. It is rather complex—how many offices get different information, how frequently you do it, what costs are involved—and obviously that hasn't stopped these types of incidents from happening. We will enhance that program more. I am questioning whether that will give us a false sense of security.

We can say that we have the greatest collection system in the world. Is Mike Smitlap, the mechanic, getting the data, and is he there with the right attitude and the right training to take the job he was training for and apply it properly and insure that that plane will be safe?

Mr. HELMS. I don't think that is the case at all, Mr. Carney. I think we have to back off and put this into perspective a little bit. This Nation has the finest and safest air transportation system in the world. How did we get there and what were the major events? The large steps have been taken—fail-safe design in wings, multiple spars. That did a significant amount to insure structural integrity. Today we are fighting for little, bitty bits all the way along to make it ever safer.

So, no, this wouldn't give us a false sense of security, but it will give us a chance for interactive inquiry, any single inquiry, to find where anyplace else in the United States we have had a problem. We are fighting for little, bitty bits of improvement safety now.

Mr. CARNEY. I would like to clarify something about that sense of security. I am sure I am not speaking of FAA. I am talking about the airline industry and everyone else saying, well, my God, FAA has this program; we are secure. Maybe with that false sense of security there would be a lapse.

I did say, Mr. Helms, in my opening statement that air travel is safe. We have a chart right here that shows airline deaths. We have to be doing something right. The chart, if we can find it, clearly indicates that the number of people that have been killed in airline accidents in the United States has declined appreciably——

Mr. HELMS. Yes, sir.

Mr. CARNEY [continuing]. Over the past several years. That, I think, is a statement of the job FAA is doing. I don't doubt that.

I noted it is 30 times more safe to fly than it is to drive your car from here to New York. I fly back and forth at least twice a week, maybe four times a week. I am vitally concerned with the safety of that plane, believe me. But what I am afraid we might be doing here—and I appreciate the dilemma you have with the GAO and with trying to refund that program; the chairman said, "I said I would support that program"—but I think what we are doing is we are moving away from a problem that we are having a very hard time identifying. And that is, how can we detect and prevent these human types of errors that so frequently cause aircraft accidents?

I believe if you took mechanical failure and the area of either the crew in the plane or maintenance crew on the ground, you will find the human error factor is probably far greater than mechanical error.

Mr. HELMS. Yes, sir. I think the advantage of the ASAS we are talking about is better put in perspective this way. First, we will never reduce our requirement, which is surveillance and increased surveillance.

The advantages of ASAS are that it will now allow the inspectors to no longer have to use their time on filling out forms and paperwork, and it will allow them more time to do the specific surveillance out on the line to which you have been addressing yourself. So we agree with you. We cannot in any way abdicate that.

The combination of increasing training and surveillance by the air carrier, increased surveillance by us, ASAS will still require all of those. It takes paperwork off our back.

Mr. GLICKMAN. The press reported recently that you were sending a team of inspectors to monitor the operation and maintenance of one particular carrier in this country because of your concern that that air carrier was not doing the necessary work on inspection maintenance. Was that a correct statement?

Mr. HELMS. Yes, sir, I have formed a particular team to take a look at a particular carrier.

Mr. GLICKMAN. Are there any other carriers that you have formed that team for, a similar team for?

Mr. HELMS. One other time I had formed a team to take a look at a specific sequence of events which happened on two or three carriers. As a result of that, I signed out implementing instructions which cost the air carrier industry over $100 million. We do that without a cost-benefit analysis. When safety comes up, I don't hesitate to take the action on it. In those cases, yes, we do it.

We don't call a lot of attention to it for the simple reason that sometimes what we find is that everything is all right. What I really want is safety. I think you get that more by leading people, motivating them into it. But we have been prepared to inspect and make darn sure they are doing it, and we are doing so.

Mr. GLICKMAN. Let us move to the issue of fires and cabin fires. I know you have been doing some work in this area for a long time in the FAA's technical center that I have been out to. Mr. Carney's been out there, too. You heard the statement of the NTSB, Mr. Burnett, that he believed that you were ready to implement regulations in this area, especially in the aftermath of the Air Canada problem. Do you plan to propose new flammability standards, seat

standards or cabin-related flammability standards based upon the results of the research you have been doing all this time?

I see a giant chart to my right. But my basic question is do you propose some standards? Then maybe you can go back from there.

Mr. HELMS. Yes, I do. But I have found, Mr. Chairman, that the FAA continually says it is a very complex subject and nobody gives us the time to show why it is so complex.

Mr. GLICKMAN. Why don't you show us why it is complex? Then tell us what you plan to do.

Mr. HELMS. All right. Let me briefly put this in perspective. If I go back to the spring 1981, I laid out for the FAA four long-term programs and plans going to the end of the century. The first was the national air space system plan, which had to do with equipment. The second was the national air space review. How do we more properly use this cubic volume of air over the Earth? Third was a system of integrated airports to improve the capacity and uses of airports. Fourth was an advanced R&D program leading to the support of the first three, identifying those other problem areas which should be pursued. Within that R&D program, then, it is broken down into numerous sections, one of which is cabin safety.

Cabin safety then is broken down into the six elements that are identified on this chart we are talking about one segment of one portion of the R&D program, which is one of four major plans for the FAA. This plan is laid out on the basis of crashworthiness; antimisting kerosene; interiors; what we refer to as the controled impact will be a combination of many other items; evacuation; finally, the supporting systems.

You will note across the bottom of the chart, July of each year has been chosen, going from 1980 to 1981 out through 1985. Starting first up, in crashworthiness—I will not attempt to go through all of them in deference to the chairman's request for time—it starts with GA impact tests in which we conducted in conjuction with NASA on the old Apollo test rig at Langley. We impacted 26 aircraft at various angles, speeds, and impact conditions. This started to give us data on the survivability of general aviation aircraft.

In the early spring of 1981 we took all of these, put them together into an integrated program directed toward regulatory action as a function of each of those outputs. So following that one across the top, then, crash scenarios were identified. A series of seat tests were conducted. Dynamic loads between the seat and airframe structure were identified. Improved seats will come out of this.

Obviously, this is leading toward the final large controlled impact demonstration next year. I will pick just one, seats, to show the example. Our critics have said we have the technology now for stronger seats. They are absolutely correct. But what they should have said is that does not necessarily mean increased survivability. Merely making seats stronger does not increase the survivability of the individual. In fact, it may make it worse. What we need is a seat that will absorb the energy at the same level as the human being can absorb it so that now the human being will survive.

Additionally, that seat will stay anchored to the floor of the aircraft. That is the reason we have had to conduct hundreds of tests and are still conducting them. In deference to our critics, yes, we can make a stronger seat. It will not increase the survivability of

the people. Our total program, then, is directed toward increasing the survivability, looking at the substructure and such things as the width of the belt. What is the difference on the individual between 2½ inches, 2¾ and 3 inches on the lower abdominal structure? I won't go into great depth on the seat, but I am prepared to. Basically we want the forward two legs of the seat to bend and collapse slowly, to absorb that energy so the human being doesn't absorb it all at once.

We have our present seats designed for 9 g's. In one test the seat withstood 53 g's, the difference is it did it in 0.03 seconds, so fast that no weight could respond. So when people say we have strong enough seats to stand up for higher g's, they should also say for what finite time period. We use about 3 seconds. No seat would stand up that long.

Using that we have continued these seat test, on the chart you see SOMLA, which stands for seat occupant model light aircraft, which is directly responsive to the light aircraft program.

In the case of antimisting kerosene, this alone could take an hour of the committee's time. We now have a formula which appears to work and meet two opposite criteria. We want it to not burn in an aircraft fire, but it must burn inside an engine or we don't convert chemical energy into mechanical energy. We have such a formula. We have been testing it. We are in the final stages, but we do not have all the problems solved.

For example, will the engine run at idle? Further, having the engine run is one thing, but will the fuel pumps work? Will the shutoff valves operate? Will the gates close when you go to an automatic crash condition in which we want those gates to be closed? I am talking about valves internally. What is the shelf life of the modified fuel? If we leave it in an airplane overnight at −60 degrees in Minnesota, will it continue to be an antimisting fuel? The additive is basically long chain polymers. They have a tendency to grab each other and, hence, not let the fuel molecules fly apart. Now we must get them up to the engine and degrade them. They react to pressure so we now have to create a specific pressure differential just before the fuel goes into the engine at the nozzle so it will burn. These are typical examples of the problems were dealing with.

Back to your fundamental question now, seat fires. We started out on seat materials. We predicted there would be some toxic results. Cyanide came out which of course, has a detrimental effect on the human being. New materials were developed and basically eliminated the cyanide component We still have irritants. Hydrogen fluoride and hydrogen chloride, but those are irritants, not necessarily lethal, in addition to the smoke.

Blocking layer data has finally come through. I have gotten the last data in May of this year, 30 days ago. So I now have, finally, the last data which I need to be able to make a decision on this. That is not true for the cabin lining panels. That will take nearly another year.

Mr. GLICKMAN. That is true for the seats you are talking about?

Mr. HELMS. Yes, sir, just for the seat blocking layers. If you take the urethane pads within the cushion which gives the buoyancy for the people to be able to float in water, when it burns it is going to

convert into hydrogen chloride, but that is an irritant. That is not so bad. Now then will the blocking layers hold down the irritant and at the same time reduce the smoke content? The answer is yes.

We now have the final data for a design of a material that we are ready to have put into production for the blocking layers which will both retard fire, retard smoke and, in fact, achieve what we have been after. Solely for the seat, though, not the carpets and inside panels as yet.

Mr. GLICKMAN. Do you propose rulemaking, then, for the seats?

Mr. HELMS. I expect to take rulemaking action within the next 30 days, Mr. Chairman. That is the month we set aside in May 1981 when we laid out this long-term program. Luck, yes. But also a lot of research and support from this committee.

Mr. GLICKMAN. Yes. So what you are basically saying is you will start your proposed rulemaking sometime next month, then?

Mr. HELMS. Yes, sir, within the next 30 days I expect to take rulemaking action.

Mr. GLICKMAN. For seats. Now what about, now the other issue you talked about, you are not ready for rulemaking then on the other——

Mr. HELMS. The panels themselves. No, sir. Not on the panels as yet. We will start the first of our full demonstration fire tests on panels tomorrow at the Tech Center in which we will establish what we call a baseline. Now that we have seat blocking layers, we have seats that can be put in and we have a carpet configuration.

We will start the first fire test tomorrow at the Tech Center in which we will measure the temperature, toxic and irritant gases, smoke, temperature, all those items. From that we will go into a program of, I think there are slightly over 200 panels of eight different chemical combinations in which we will take these panels, some as long as 96 inches, some as small as 12 by 25 inches, and substitute this into this modeling and conduct fire tests. This will take us a year.

Mr. GLICKMAN. So right now do you have any idea on timing for possible rulemaking on the fire blocking materials, nonseat related? A year?

Mr. HELMS. I wouldn't refer to it as fire blocking. I think we would say improved fire retardant panels. My current schedule calls for late 1984. I have no reason to believe I am not going to make it.

Mr. GLICKMAN. What about the issue of less flammable windows?

Mr. HELMS. We have tested less flammable windows. In fact, we get about a 400-percent improvement. What has not been demonstrated is their capability to stand temperature cycling between going up to high altitude at minus 65, coming down in the desert at 110. We do not yet know what the fatigue cycling and reliability of the windows are.

In addition, there seems to be some slight difference in the expansion ratio of that material to the metal frame around it. Therefore, we may induce metal fatigue failure. Of course they are hairline but that is all it takes. So, yes, we do have a material which has significant improvement of windows which will serve to improve it, but we just have some more work to do on that.

Mr. GLICKMAN. The last time I flew home I talked to one of the folks who services the airplane. He tells me that if I told you how many cigarette butts I find in a lavatory every time I clean out the airplane, you would be shocked. I said what are you talking about? He says on the numbers of people who go back into the back of the plane and smoke. Either drop the cigarette into the toilet itself or, obviously far more catastrophic, drop the cigarette into where you throw your dirty towels and that kind of thing. I would like to ask you several questions on this whole related issue.

First, why are there no FAA requirements for smoke detectors in airplane lavatories?

Mr. HELMS. NTSB originally recommended this. We took the approach of let us prevent the fire and contain it rather than to depend solely on alarming someone when the alarm device itself may fail. So, first we restricted smoking in lavatories. Second, we constructed and required, it is part of the Federal air regulations, that the interior of all of these containers must be fireproof. So that if a fire starts in there, and incidentally that is the reason why when you drop your paper towel or something you must push on it, it is spring-loaded up. Those are designed so if there is a fire in there that they will burn themselves out and be contained. So we took the approach of making it illegal since it is a violation of regulations to smoke there.

Second, to contain that within a fireproof area. Additionally to that, certain carriers do install fire detectors and automatic dispersal units.

Mr. GLICKMAN. But at this stage you don't see anything necessary to make that a requirement? Given the fact that obviously the prohibition against smoking in lavatores is probably one of the most ignored FAA prohibitions we probably have today.

Mr. HELMS. I don't know whether it is ignored or whether it is in response to the FAA's requirements. For example, if you were smoking and walked in and saw a sign that said "no smoking" just as you do in an elevator, you put it out. I am not able to say. So what we may be seeing is the person putting it out in response to that.

But we have researched our records going back to the introduction of jet aircraft. There is not one case on record since jet aircraft were put into service in the United States that a passenger has lost his life due to an in-flight fire. That is not a bad record. So when we go back and look at this, we are not able to substantiate a problem. No U.S. carrier operated by U.S. crews has ever had a fatality due to a fire in flight in jet aircraft. So something must be going right without that.

Mr. CARNEY. As long as we are on the smoking, it hasn't been determined has it that that was the cause of the fire on the Air Canada flight?

Mr. HELMS. I shouldn't comment on that but—I don't know what NTSB has said. That is properly their role. That is a Canadian operator, and I should not make any comments on what the Canadian CAA, or it is actually called Air Transport Canada, what they have as a requirement. But I have seen no announcement to the effect that that caused the fire, no.

Mr. CARNEY. Thank you.

Mr. GLICKMAN. You know when we talk about the issue of fire and flammability, seats are part of the problem.

Mr. HELMS. Yes, sir.

Mr. GLICKMAN. You talked about other parts of the airplane, though, that can and would burn. How significant a part of the problem will be remedied by fire resistant material in seats?

Mr. HELMS. By far the majority. Seats are by far the largest contributor to the fire problem. Further, it is the flashover that is the significant item. When we started these tests 3 years ago we really didn't know what this phenomena of flashover was, Mr. Chairman. The best minds in the country sat down to take a look at it and assumed that under a normal burning situation you would have an increase in temperature, increase in smoke and toxic fumes, increase in irritant gases. But no one thought it would go to a given level and given set of conditions within seconds, and I mean seconds, 1 to 2 seconds for flashover.

You would see this flashover situation occur in which it no longer is survivable. Once we found this, this is part of the problem, our critics said you have known this for a long time. We did not know about flashover and how to prevent flashover which is what we have been working on. If we can delay the point of flashover, you have now established the greatest single contributor to the preservation of life. That is by far the most significant for the airplane on the ground.

First, eliminate flashover, and get out of the aircraft as fast as possible.

Mr. GLICKMAN. On retrofit, will your proposed regulations call for retrofitting existing seats?

Mr. HELMS. Yes, Mr. Chairman, we will have a retrofit scheduling.

Mr. GLICKMAN. One of your folks, or perhaps NTSB, indicated they do retrofitting as a matter of course anyway.

Mr. HELMS. Yes, sir, he said 2 years. I think if you plot it out on a curve you will see it is closer to 3 years, but the difference is not that much. About every 3 years it is a routine update by carriers, and they do in fact install new interiors. If we made the decision today to retrofit all 2,000 aircraft immediately, we couldn't possibly have the material manufactured and installed any sooner than our 2 to 3 year schedule.

Mr. GLICKMAN. Do you expect airline resistance from this proposed regulation?

Mr. HELMS. Yes, sir. Not in the interest of safety but in response to the schedule that we desire. I suspect they are going to want longer.

Mr. GLICKMAN. I would just encourage you to indicate your safety concern, which you have in your hearing today and previously, and move ahead as expeditiously as possible, because I think the flying public will want to know fire resistant seats are in the airplanes they are flying in. Once they know the materials are available, they won't believe there will be much excuse for delay.

Mr. HELMS. That is the reason that now that I have the data, we are now looking at the blocking layer manufacturer's schedule to see what can be done, when we can get it. Remember, the purpose of the FAA is not to approve a particular material. That is some-

thing for somebody else to do. Our job is to set standards and let other people come up with the material to meet it. So we don't want to be in a position where only one manufacturer or one unique capability exists. We want multiple sources.

Mr. GLICKMAN. Finally, I would ask you, some have criticized you for spending years and years of researching things, and it took an accident fire in an airplane in order to expedite you to move towards the rulemaking on cabin fire safety. I wonder if you might comment.

Mr. HELMS. I am sure the chairman refers to the Air Canada accident in Cincinnati. It had absolutely nothing to do with it. My internal schedule laid out early in 1981 specified a target date of July this year. On three items I reviewed in March and April of this year relating to cabin safety I have made decisions then on dates, seat blocking material is one of them. It had no impact on us at all.

I certainly regret any aviation tragedy but testing is successful only when it meets two criteria. It meets the end objective and it does not create a worse, alternate problem. It is the latter that takes so much time. So many times, yes, we have a technical solution but it creates a worse, alternate problem. Therefore, we have to continue to go on testing.

Mr. GLICKMAN. Thank you.

Mr. Carney?

Mr. CARNEY. Mr. Helms, you laid out much of that schedule to this committee back in 1981. I just want to say that for the record. I certainly believe that you could not make standards in the time frame from when the Cincinnati accident happened to when you project you will be announcing them within the next 30 days.

Mr. HELMS. I would be remiss, Mr. Carney, if I did not compliment the committee because when I laid out the program in 1982 we had $80.8 million of R&D funds. The committee provided over a 50-percent increase. We went to $121.2 million in 1983. I laid out what I wanted for 1984 to the committee, and it was more than doubled to some $280 million and the committee supported that. So the progress we have made is basically because of two items. We laid out a good sound detailed systems engineering plan in early 1981, and this committee supported it.

Mr. CARNEY. You are looking at two thrusts if I remember correctly. Your two primary thrusts would have been cabin safety and the fuels problem, because historically, fires are caused by the crash. I can remember seeing the film that you showed where if you could hold down the misting, the plane would leave the fire.

Mr. HELMS. Yes, sir.

Mr. CARNEY. It would ride right through the fire. That is something that interested me then. It interests me now. You gave a great description as to the problems associated with those types of fuels, the antimisting fuels. Could you give us an idea of when you might have available to the industry a type of fuel that would have the properties you are seeking?

Mr. HELMS. I believe we have achieved the chemical formula we need with very slight additions. What we refer to as FM-9 now we have been able to modify in these tests the last 6 months. So we are very close to that. Now the question is how do we get this into the infrastructure in such a way that we can have reliability? How

many fuel pumps will have to be changed; that is, tank trucks, throughout how many airports, because unless we make this an additive or formula or unless we make it something which can be used, it has little value. So my judgment is by late next year, late 1984, I am going to be in a position to have sufficient confidence to take rulemaking action.

But I want to introduce a word of caution now on this one. Until we see a little bit more about the effects of temperature soak, vibration—I don't know if these molecules will stay together under vibration. Boeing is running this down. GE is designing and building a degrader. This is the item that will take that fuel just before it goes to the engine, put it under pressure and break those molecules apart so the fuel will burn in the engine. My confidence is pretty high, though. We have had good luck. I am going to shoot for late 1984.

Mr. CARNEY. You have mentioned many of the leaders in the aviation industry involved with propulsion just now. Have they contributed or are they doing contract work for FAA, or are they doing this type of R&D program on their own because they recognize it will enhance their position?

Mr. HELMS. I think perhaps from my own personal perspective our approach in the past was to try to be more regulatory or directive rather than cooperative. In working with the industry I find they are putting in $3 or $4 for every $1 we put in. For example, I didn't issue a regulation, to the general aviation industry requiring them to change the fuel nozzles so you can no longer put jet fuel into gasoline-powered aircraft. I sat down, had a series of meetings with them and said, here is the problem. Here is the time frame. If you don't correct it, I will. They did. They did it in less than a 1 year. It would have taken us 2 years to initiate the action and get it through.

In the case of aluminized slides to get out of aircraft, we did this through a technical standard order. We try to do it low key because the corporations, under those circumstances, will work with us.

Mr. CARNEY. We mentioned other corporations who are leaders in the field. If I am not mistaken, there was an enormous amount of R&D done in Britain on antimisting fuel.

Mr. HELMS. And still is, Mr. Carney. We work very closely with our counterparts in the UK industry on this problem. It would be well if we had everything ready next year, but let us make sure there is not something else we have stepped on that would bite us and make sure there isn't something around the corner that could be put into the fuel that would solve the problem now. I want the whole thing to be done for under 3 cents a gallon. It is going to be very hard for the industry to turn me down if we can put the system into effect and hold costs to 3 cents a gallon.

That is what I am pointing to. Not because economic impact is such that it wouldn't work, it is because that will motivate people to do it. If you take Eastern Airlines in 1980, their fuel bill was $ billion. Just for the mathematics of showing this, if amk cost 3 cents a gallon and full cost $1 a gallon we are talking $30 million. We are talking a lot of money. Eastern burns about 10 percent of the jet fuel used by the industry in a year. The industry-wide costs

would then be about $300 million a year. So we are not talking peanuts at 3 cents a gallon.

Mr. CARNEY. You have mentioned that you have cooperated with other agencies, for instance, your counterpart in Britain. Maybe this is a loaded question. I don't mean it to be. I mean this to be an earnest and honest question. How does the FAA compare with agencies of other Western countries as far as the amount of money we spend on research and safety and maintenance of our air space?

Mr. HELMS. First, of course, our problem is vastly different than any other single country, so that to the extent we try to say dollar per mile of airways and dollar per passenger it would be very difficult to do so. Second, we are a very sophisticated country, a highly mobile population, highly mobile people, so a greater percentage of our people travel. But the fundamental thrust of your question really comes down to are we as far ahead or are we up to date in technology, is our R&D technology keeping us abreast? On that I have no hesitancy.

In December I visited seven countries. Again in May and June I got into detail with three others of the most advanced Western nations. I just returned from a meeting with the president of ACAWIN in Montreal, with the secretary general, my counterpart in Canada. Without exception I can tell you the FAA is further ahead in R&D, application of this into a more meaningful safety step than any country in the world.

Mr. CARNEY. Again I congratulate you for going out and comparing our system with other systems. You must understand if I did that, I would be a junketeer.

Mr. HELMS. I am not so sure but I may get the same label, but I want to know.

Mr. GLICKMAN. Let me just ask you before we let you go, this crash test you are proposing in 1984, you are going to crash a 720, is that correct?

Mr. HELMS. No, sir. Crash implies uncontrolled impact. This is not uncontrolled. It is a purposeful impact of an aircraft fully loaded with fuel that would be fully instrumented for structural loads throughout the fuselage, throughout the wings, up through the engine, into 75 different seats, 6 different type design dummies. It is a massive thing. The reason is we want to know how much of the undercarriage of the fuselage will absorb energy. It will be conducted at about the upper limit of human tolerance, 17- to 18-feet-per-second impact. We want that data.

Mr. GLICKMAN. How are you going to do it?

Mr. HELMS. We are going to fly it into the ground. It is a joint NASA effort. It is a program that has been underway now for some time. NASA has been outstanding in their support and in seat design and fuel.

Mr. GLICKMAN. I assume none of your detractors are going to be in the cockpit of this plane?

Mr. HELMS. I don't think just a Boeing 720 would carry them all, Mr. Chairman. [Laughter].

In a more serious vein, it is intended to give us the interaction, dynamics, of various loads. So we will arrange it so the force will bend up, so we know what causes a seat to tear out. If the seat area of the floor stays flat, you have one resistance to failure of the

seat. If you break the floor level, immediately you have a significant degradation in the capability of that individual to survive. So there are a whole series of tests we have going. We will have posts sticking out of the ground at various parts so we break open a fuel tank on purpose. We want to shear wings off and see if a flame erupts. All four engines will be running. So it is a combination of many, many experiments.

This will be the culmination of an area of testing we have laid out. So you will see on the chart an item that says executive summary. At that time in 1984 I expect to have the results from these tests and others put together so that between now and, say, the spring of 1985 a number of regulatory actions can finally be taken by the FAA, not just one or two.

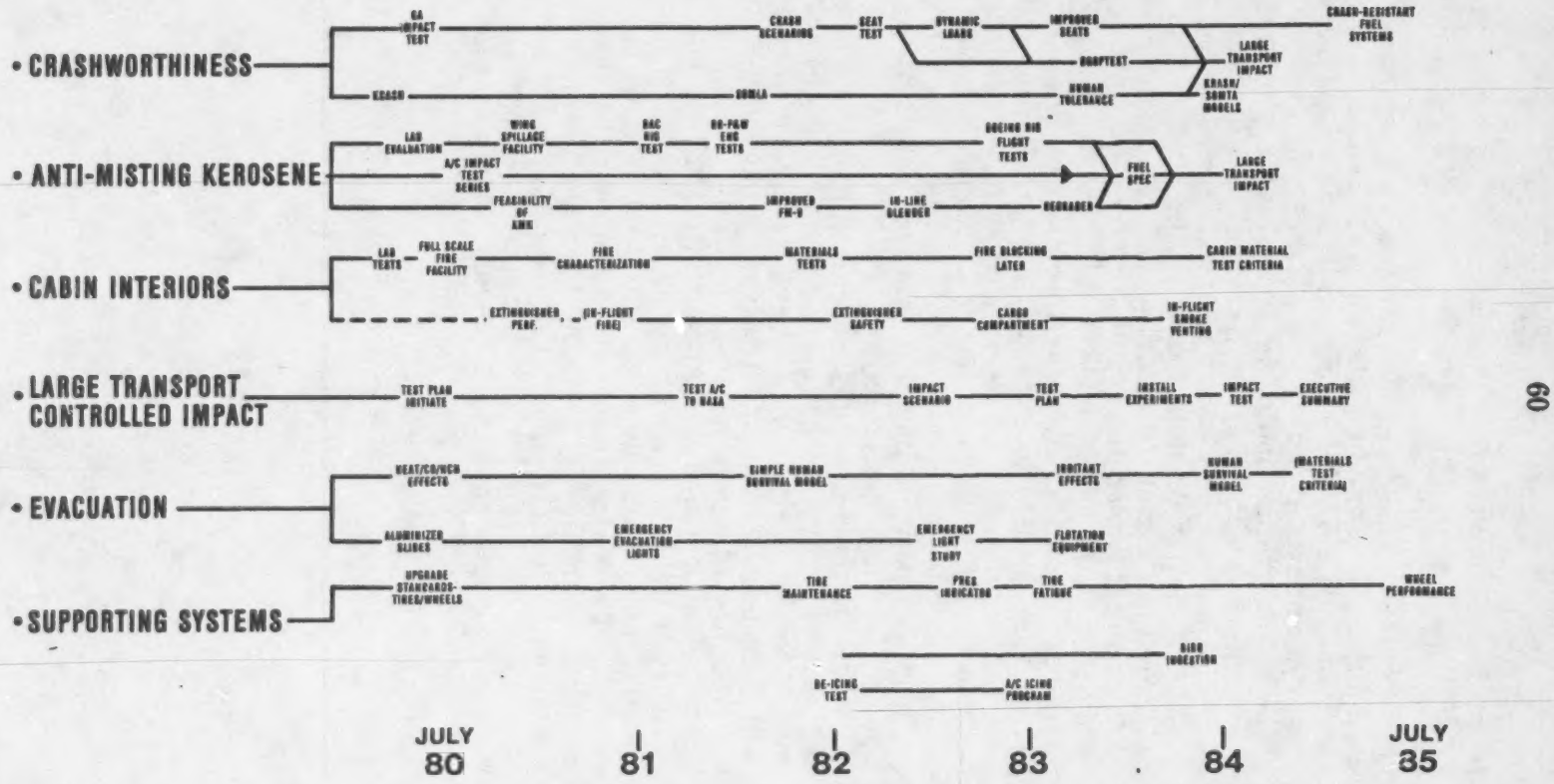
Mr. GLICKMAN. I want to thank you for being here and all the issues you have talked about today, particularly the cabin fire safety issue, I am pleased to know you are going to move ahead with a regulatory proposal on seats. I would encourage you to move as expeditiously and as fairly as you can, because once the flying public knows there are fire resistant seats available, they are going to want them on the plane they are flying on, not down the road some 3 years in a regulatory proceeding.

But I realize you have to comply with all aspects of Federal law. I am also pleased to know that you are proceeding on the research programs. As you are well aware we have managed to get some increases in those programs, and that they seem to give us some success in moving toward regulatory——

Mr. HELMS. During the chairman's absence I acknowledged this to Mr. Carney. It is certainly with the strong support of this committee, and I must say about every month or two the chairman pins me down at breakfast to make sure we are making technical progress. That is very fine. But without the support of the committee we wouldn't be as far along as we are, Mr. Chairman.

Mr. GLICKMAN. I am sure we will have more questions of you and your staff as time goes on. I thank for now, though, you have answered our questions. Thank you very much.

[Chart follows:]


• CRASHWORTHINESS
GA IMPACT TEST
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SEAT TEST
DYNAMIC LOADS
IMPROVED SEATS
CRASH-RESISTANT FUEL SYSTEMS
DROPTEST
LARGE TRANSPORT IMPACT
KRASH
DOMLA
HUMAN TOLERANCE
KRASH/ SOMTA MODELS
• ANTI-MISTING KEROSENE
LAB EVALUATION
WING SPILLAGE FACILITY
BAC BIG TEST
DC-PAW EMC TESTS
BOEING BIG FLIGHT TESTS
A/C IMPACT TEST SERIES
FUEL SPEC
LARGE TRANSPORT IMPACT
FEASIBILITY OF AMK
IMPROVED FM-9
IN-LINE BLENDER
DEGRADER
• CABIN INTERIORS
LAB TESTS
FULL SCALE FIRE FACILITY
FIRE CHARACTERIZATION
MATERIALS TESTS
FIRE BLOCKING LATER
CABIN MATERIAL TEST CRITERIA
EXTINGUISHER PERF.
(IN-FLIGHT FIRE)
EXTINGUISHER SAFETY
CARGO COMPARTMENT
IN-FLIGHT SMOKE VENTING
• LARGE TRANSPORT CONTROLLED IMPACT
TEST PLAN INITIATE
TEST A/C TO NASA
IMPACT SCENARIO
TEST PLAN
INSTALL EXPERIMENTS
IMPACT TEST
EXECUTIVE SUMMARY
• EVACUATION
HEAT/CO/HCN EFFECTS
SIMPLE HUMAN SURVIVAL MODEL
IRRITANT EFFECTS
HUMAN SURVIVAL MODEL
(MATERIALS TEST CRITERIA)
ALUMINIZED SLIDES
EMERGENCY EVACUATION LIGHTS
EMERGENCY LIGHT STUDY
FLOTATION EQUIPMENT
• SUPPORTING SYSTEMS
UPGRADE STANDARDS-TIRES/WHEELS
TIRE MAINTENANCE
PSES INDICATOR
TIRE FATIGUE
WHEEL PERFORMANCE
BIRD INGESTION
DE-ICING TEST
A/C ICING PROGRAM
JULY 80
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JULY 85

Mr. GLICKMAN. Our next witness is Dr. Raymond Colladay, Deputy Associate Administrator of NASA.

It is a pleasure to have you here. We have your statement which you may feel you either want to read or summarize, at your pleasure.

STATEMENT OF RAYMOND COLLADAY, PH.D., DEPUTY ASSOCIATE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, ACCOMPANIED BY ALLAN R. TOBIASON, PROGRAM MANAGER, AVIATION SAFETY TECHNOLOGY

Dr. COLLADAY. Thank you, Mr. Chairman. I appreciate the opportunity to appear before you today to discuss NASA's fire safety research. With the permission you have just granted I will submit my prepared testimony for the record and summarize here.

Before proceeding, however, let me introduce Allan Tobiason, program manager of our aviation safety program.

As you will recall, we testified before this subcommittee and the Investigations and Oversight Subcommittee in a joint hearing 1 year ago last March. Today I would like to give you an update on cabin fire safety. Last August the joint report recognized the 1980 recommendations of the Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee, which cited the benefits of fire blocking layered seat cushions and expressed the need for prompt implementation of resulting advances.

This morning I would like to focus on the main aspects of cabin fire safety that NASA, in cooperation with the FAA and industry, has pursued as a result of those recommendations. We believe this has made possible the elimination of a major fire hazard, that associated with rapid combustion of seat cushions. Seat cushions have been identified as the greatest single interior materials source of fuel for cabin fires. Under a NASA/FAA agreement with, and FAA funding support, NASA Ames Research Center, together with the airframe materials and chemical companies, evaluated the effectiveness of various available fireblocking materials for use as seat cushion covers as a means of breaking the fire chain.

We have completed small-scale and full-scale fire and durability tests using the unique facilities at NASA Ames, FAA Atlantic City and Douglas and Boeing. Selected configurations were then tested in typical airline installations with various external fire threats using the FAA C–133 full-scale fire facility at Atlantic City. Our part of the research was completed last summer and reported to the FAA fall. The results were very impressive, as Mr. Helms has indicated. The use of fire-blocking layers over polyurethane foam cushions without fire retardant additives can dramatically extend evacuation times and survivability without significant weight penalty.

In regard to in-flight and ramp fires, I would expect these fireblocked seats to perform better than in the postcrash fuel fed scenario. In fact, the FAA Technical Center, C–133 tests demonstrated these seats would self-extinguish when ignition sources typical of in-flight and ramp fires were self-consumed. These research results and those of subsequent FAA-recommended intermediate scale testing are being published and considered for implementation by the

FAA in rulemaking, as we have just learned from Mr. Helms' statement.

Although NASA has completed its support effort on these fire-blocked seat cushions, as the industry continues to pursue more effective materials and evaluate them against forthcoming FAA standards and criteria, we will certainly assist where we can be of help. In fact, in a related cooperative effort between DOD and NASA, the Ames Research Center has discussed this fire-blocking layer technology with the Air Force and Lockheed for use in C-5B transport aircraft. Nor are the benefits of this technology limited to aviation safety. Interchanges among NASA, FAA, National Bureau of Standards, universities, and industry, have led to transfer of lessons learned to other potential applications in mass ground transit and public buildings. Despite these encouraging developments, however, as was pointed out, the postcrash fire problem doesn't end with removal of the seat cushion from the fire chain. Similar research needs to be done, and is in fact underway in a cooperative program between FAA and NASA, to investigate interior wall, ceiling and floor panels. NASA and the FAA have begun a joint program to evaluate various in-service and panel advanced designs in the FAA C-133 under various simulated fire threats.

The program goal is to determine incremental improvements in occupant survivability and egress time associated with improved panel materials used in combination with fire-blocked seats. NASA is now completing delivery of typical in-service advanced panels for these C-133 tests scheduled to begin this week. A forthcoming NASA Ames and FAA Tech Center agreement will define a similar new task to be completed by September 1984 to meet the schedule Mr. Helms has laid out for the panel rulemaking. In these tests, NASA and industry will fabricate small scale and full scale panels using graphite fibers for a weight savings on the order of 20 percent relative to the current fiberglass based panel facings.

New resins and decorative surfaces will be used with graphite fibers to further advance fireworthiness while reducing weight. Fire resistance of these advanced panels will be compared with the most advanced panels currently in service. Again, advanced seats will be used in these C-133 tests. There is a continuing need in full scale C-133 tests and related research to investigate and understand the interrelationships among the various internal components. For example, when we were looking at the fire-blocking capability of the seatcover, a parallel program had to be undertaken by the FAA to investigate their flotation capability.

There are several other NASA cabin material fire safety research programs that I would like to briefly mention. The NASA Jet Propulsion Laboratory [JPL] has concentrated on thermochemical modeling to understand the fire environment at the interface between the fire and the blocking layer. JPL also supports the overall FAA fire-modeling program with specific focus on understanding the complex dynamics, supported by data both from the JRL tests as well as those data from the C-133 tests at the FAA Tech Center.

Fire resistant cabin windows developed by NASA and industry were tested on one quarter and full scale facilities at Atlantic City.

The use of intermediate epoxy polycarbonate lamination resulted in more than a fourfold increase in the time required for the fire to penetrate the window, making the window panel virtually as fire resistant as the fuselage. Other considerations such as pressure cycling, maintenance, ultraviolet light exposure, differential expansion and mounting of the windows has to be examined.

Fire safety research at Johnson Space Center [JSC] also supported the fire-blocking layer technology development as well as fuselage burn through testing and advanced fireworthy cabin floor panel research. Two JSC Boeing graphite floor panels are being evaluated over a 3-year period for wear maintainability on a Boeing 747. The Safer committee and the August 1982 report of the combined subcommittees concluded that antimisting kerosene [AMK] has the greatest potential for reducing the postcrash fire risk by eliminating the fuel-fed external fire. That was pointed out in some detail by Mr. Helms this morning.

I won't go into any more detail other than to say that in a joint effort between NASA Lewis, our propulsion center, and Pratt & Whitney, we have been working with the FAA in identifying the performance of engine configurations using the AMK additive.

In summary, NASA has participated closely with the FAA and industry in safety research to develop both near and long term practical solutions. Improved fireworthy materials research has been a complex subject, but it has progressed rapidly because of the commitments on the part of the Government including this subcommittee, and because of similar commitments by the aviation industry, and concern on the part of the traveling public.

We now have an opportunity to implement the results of the research in the form of fire-blocking seat cushions through the rulemaking process. In the not too distant future implementation decisions can be made on advanced panel technology. Government and industry have learned collectively the important process of scaled fire testing and economic evaluation that links design, material selection, and test methods. This cooperative process has established a credible information base from which to support important implementation decisions for enhancing air crew and passenger safety. Such safety efforts will continue to be an important area of NASA's efforts.

That concludes my prepared statement. I will be happy to answer any questions.

[The statement of Dr. Colladay follows:]

HOLD FOR RELEASE UNTIL
PRESENTED BY WITNESS
JUNE 27, 1983

Statement
of
Dr. Raymond S. Colladay
Deputy Associate Administrator for
Aeronautics and Space Technology

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Subcommittee on Transportation, Aviation
and Materials
Committee on Science and Technology
House of Representatives

Mr. Chairman and Members of the Subcommittee:

I welcome this opportunity to appear before you to discuss NASA's fire safety research. I am accompanied today by Mr. Allan R. Tobiason, who is our Aviation Safety R&T Manager. As you know, Dr. Kerrebrock described NASA's overall aviation safety research program, including fire safety, to the combined membership of this Subcommittee and the Investigations and Oversight Subcommittee on March 9, 1982. The Subcommittees' August 1982 report contained recommendations concerning post-crash fires and other safety related topics. Your report recognized the 1980 Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee Report to the FAA Administrator, and cited the benefits of antimisting kerosene and fire-blocking layered seat cushions in breaking the fire chain between pooled fuel and cabin interior materials. Your recommendations also noted the cooperative nature of NASA, FAA, and industry research, and the need for prompt implementation of the resulting advances.

Recent accidents such as the Air Canada DC-9 in-flight fire have highlighted the importance of fire-safety research. This accident is currently under investigation by the National Transportation Safety Board (NTSB), and NASA will provide whatever assistance NTSB may request. Although the in-flight fire scenario is different from, and rarer than, the post-crash fire which was the focus of the SAFER study and the research it fostered, we are very aware of the need to understand how the new materials evolving from our research would perform in the event of in-flight fire as well as in a post-crash situation.

In my testimony today, I would like to focus on two main aspects of cabin fire safety that NASA, the FAA, and industry have pursued vigorously as a result of the 1980 SAFER recommendations. We believe this cooperative research has made possible the elimination of a major fire hazard -- that associated with rapid combustion of seat cushions. Seat cushions have been identified as the greatest source of fuel for cabin fires. Under a NASA-FAA agreement and with FAA funding support, NASA Ames Research Center -- together with the airframe, materials, and chemical industries -- evaluated the effectiveness of various practical, available fire-blocking layers of material for use as

seat-cushion covers as a near-term means of breaking the fire chain. Ames and the industry successfully completed small-scale and full-scale fire and durability tests at unique Ames, Douglas, and Boeing facilities. Selected successful configurations were then tested in typical airline installations, with various external fire threats, using the FAA's C-133 full-scale fire facility in Atlantic City, New Jersey. The research was completed last winter. The results indicate that the use of fire-blocking seat covers -- even on conventional non-fire-retardant cushion foams -- can dramatically extend evacuation times and survivability without significant weight penalty. The research results, and the results of subsequent FAA-recommended intermediate-scale testing, are being published and considered for implementation by the FAA.

Although NASA has completed its support effort on seat-cushion fire retardation, we fully expect that the industry will, as time goes on, advance more effective materials for evaluation against forthcoming FAA standards and criteria. We will assist in such activity wherever possible. We are pleased to have participated with the FAA and industry in this short term safety effort and we support the current government and industry interest in introducing this technology. This research, incidentally, has also been reviewed and endorsed by a special committee of the Aerospace Industries Association of America (AIA). In a related cooperative DOD/NASA safety program, Ames has discussed the newly developed fire-blocking layer technology with the Air Force and Lockheed for use in C-5 aircraft. We understand that the Air Force is contemplating purchase of several thousand seats.

Despite these encouraging developments, the post-crash fire problem still requires considerable further research. The large surface interior wall, ceiling, and floor panels are also seriously involved in fires, especially when fire propagation is aggravated by conventional seat cushions. These and other components, such as cabin windows, have also received NASA, FAA, and industry critical attention. In parallel with the seat research, NASA and FAA established a priority program in which in-service and advanced panels can be evaluated in the FAA C-133 under various simulated fire threats. The program goal is to determine the incremental improvements in occupant survivability and egress time associated with improved panel materials used in combination with fire-blocked seats. NASA is now completing delivery of typical in-service and advanced interior panels for these C-133 tests scheduled to begin this summer.

A forthcoming NASA Ames-FAA Technical Center (FAATC) agreement will define a new similar task to be accomplished by September 1984. In this one-year effort, NASA and Boeing will fabricate small-scale and full-scale panels using graphite fibers for weight savings on the order of 20 percent relative to fiberglass based panel facings. New NASA-industry resins and decorative surfaces will be used with graphite fibers to further advance panel fireworthiness while reducing weight. The fire resistance of these advanced panels will be compared with the most advanced panels currently in service. Again, advanced seats will be used in these C-133 tests. There is a continuing need, in such full-scale C-133 tests and related research, to investigate and understand the interrelationships among various interior materials and components. One safety solution cannot be allowed to create a new

danger. For instance, since the fire-blocked layer seat cushion must also perform as a flotation device, NASA's focus on the fire propagation problem had to be supplemented by parallel FAA examination of the flotation aspects.

In regard to in-flight and ramp fires, one would expect the fire-blocked seats to perform better than in the post-crash fuel-fed scenario due to the lower fire threat. In fact, the FAA Technical Center's C-133 test results demonstrated that these seats would self-extinguish when the ignition sources were self-consumed.

There are several other NASA-FAA cooperative cabin materials fire safety research programs that I will briefly discuss. In support of the cooperative fire-blocking layer research, the NASA Jet Propulsion Laboratory (JPL) and the FAA Technical Center concentrated on thermo-chemical modeling to understand the fire environment at the interface between the fire and the blocking layer. JPL also supports the overall FAA fire-modeling program with specific focus on understanding the fire dynamics measured in the C-133 tests and in the small-scale fire research facility at JPL. The value of the interchanges among NASA, FAA, National Bureau of Standards, universities, and industry is not confined solely to aviation safety. The lessons learned in areas such as blocking layer technology have important potential applications, for example, in mass ground transit and in public buildings. In fact, the Douglas cabin fire simulator used in the blocking layer research was used by the University of California (Berkley) and the Public Utility Commission in developing advanced fireworthy seat cushions for the Bay Area Rapid Transit (BART).

Fire-resistant cabin windows developed by NASA Ames Research Center and industry were tested against an external fire threat by the FAA Technical Center in a one-quarter-scale facility. The use of an intermediate epoxy-polycarbonate lamination resulted in more than a four-fold increase in the time required for the fire to penetrate the window, making the window panel as fire resistant as the metal fuselage itself. The FAA is publishing a final report on the improved window technology. Other considerations such as pressure cycling, maintenance, and ultraviolet light exposure must be examined before this technology can be adopted.

Fire safety research at the Johnson Space Center (JSC) also supported the NASA, FAA, and industry cooperative research in fire-blocking-layer technology development, and the fuselage burn-through testing and advanced cabin floor panels research. Two JSC-Boeing graphite floor panels are being evaluated over a 3 year in-service period for wear and maintainability on a B-747.

The SAFER Committee and the August 1982 report of the combined Subcommittees concluded that the Antimisting Kerosene (AMK) concept has the greatest potential for reducing the post-crash fire risk by eliminating the fuel-fed external fire. I will briefly summarize NASA research in this area. NASA and FAA have been conducting research in preparation for a demonstration of AMK in a full-scale remotely piloted transport crash at Edwards AFB planned for 1984. NASA Lewis Research Center and the Pratt & Whitney Aircraft Company have

completed an assessment of the compatibility of the United Kingdom-developed FM-9 AMK research fuel with the JT-8D engine. Engine components needing modification or redesign were identified. FAA has used this analysis and other FAA-industry inputs to fabricate the necessary hardware for installation on the crash test airplane in early 1984. NASA-JPL has also assisted the FAA in laboratory testing of FM-9 AMK in the areas of flammability, rheology, and fuel specifications, and JPL has assisted FAA in evaluating alternative AMK additives.

I have discussed fireworthy cabin interior materials and safety fuels which address the cause of the majority of post-crash fire fatalities. Fire safety technology has progressed well towards developing the technical information that both government and industry need for implementation decisions. Apart from fire, NASA-FAA research is also directed at reducing the effects of crash impact on passengers and crew. This recently initiated research in transport crashworthiness addresses a slightly lower and less understood accident statistic than the statistic representing fire-caused fatalities. Although this crash-impact dynamics effort was outside the scope of SAFER activity, NASA gained valuable crash-impact insight by participating in this activity. As in the fireworthy materials research, NASA, FAA, and industry defined research opportunities in the initial effort by studying world-wide statistics and accident reports. Laboratory and intermediate-scale seat restraint research, including instrumented anthropomorphic dummies, is now underway at NASA Langley Research Center. Surplus transport aircraft fuselage sections dropped from test towers are used to understand subcomponent behavior and to develop transport aircraft analytical models. NASA's major objective in the full-scale transport crash program, apart from support to FAA in the AMK demonstration, is to collect accurate data on the crash dynamic response of the airframe structure and to obtain the load path distribution between airframe, subfloor and seat structures. Advanced seats and restraints will also be evaluated. The test results will provide a well documented data base to support development of advanced analytical methods for use in future aircraft designs, which are expected to include extensive use of large composite structures.

NASA has participated closely with FAA, other government agencies, and the industry in safety research to develop both short and long-term practical solutions. Improved fireworthy materials research has progressed rapidly because of the sincere commitments of government agencies, including this Subcommittee, and because of similar commitments by the aviation industry and concern on the part of the traveling public. We now have an opportunity to implement the results of the research in the form of fire-blocked seat technology and advanced panel technology. Government and industry have learned collectively an important process of scaled testing and economic evaluation that links design, materials selection and test methods. This cooperative process has established a credible information base for enhancing aircrew and passenger safety. A similar process is being utilized in the other high payoff areas of safety fuels and crash-impact dynamics. These latter areas will require continued attention if we are to reap important safety benefits in the minimum practical time. Safety research efforts in cooperation with other concerned government agencies and industry will continue to be an important element of NASA's aeronautics program. We appreciate the support of NASA safety research provided by this Subcommittee, and sincerely hope we can continue our cooperative efforts in the future.

Mr. GLICKMAN. Thank you. You indicated the fire-blocking layer research program has been successful and that the use of these fire-blocking seatcovers has made possible elimination of a major fire hazard, aircraft seat cushions. Do you believe the FAA now has all the information that it needs to upgrade their current cabin material flammability standards for seats?

Dr. COLLADAY. Yes, Mr. Chairman, I do. I feel the technology base is in place on the fire-blocking layer technology.

Mr. GLICKMAN. And do you think the airlines and aircraft manufacturers are aware of the effectiveness of these fire-blocking materials for seats?

Dr. COLLADAY. Yes, sir, I do. They have been participating with us both formally in contracted research and informally in workshops and technical briefings so that they have been aware of the research results, and they do understand the capability of these blocking layers.

Mr. GLICKMAN. Is there a weight penalty associated with these new seat materials?

Dr. COLLADAY. A very slight weight penalty, but not substantial.

Mr. TOBIASON. When you look at the optimized layer, Mr. Chairman, the weight penalty is virtually zero, especially when you take the fire-retardant additive out of the foam and substitute the blocking layer, there is essentially no weight difference in the seat itself.

Mr. GLICKMAN. So from the standpoint of the operational costs of an aircraft; that is, what it would do to fuel consumption or anything else, you are saying the total weight, let's say, on a retrofitted Boeing 727, would be nominal?

Dr. COLLADAY. That is correct.

Mr. TOBIASON. I might add the polyurethane weight in airplanes today in the domestic fleet amounts to about 2 million pounds.

Mr. GLICKMAN. Is the cost of these materials comparable to seat materials currently in use? Do you have any knowledge of what we are talking about in terms of cost?

Mr. TOBIASON. As part of the agreement with the FAA, we did develop a cost/weight performance model, which is computer based and which the FAA can use to look at any particular material. As a matter of fact, since we have completed the program there are at least two new fire-blocking materials that have come onto the scene from industry and which have been tested by FAA and Boeing. These new materials meet all the current requirements and as we understand, they weigh half as much as the best blocking layer we tested. If one takes that computer model, inputs the raw materials, manufacturing costs, and installation costs, and fuel consumption, one will probably come out with a very, very small cost disbenefit, you might say, to the airline community.

The numbers and computer model have been turned in with our final report to the FAA, on the best known technology that we completed last summer.

Mr. GLICKMAN. You say there have been some new materials that have come out since the tests were completed?

Mr. TOBIASON. Yes, sir.

Mr. GLICKMAN. The materials, by somebody who manufactures seats?

Mr. TOBIASON. Yes, sir, by the chemical and materials industry itself. There are at least two new products I am aware of that probably weigh half that of the best fire-blocking material we tested last year.

Mr. GLICKMAN. I understand one of the most promising fire-blocking materials is something called Norfab. What is Norfab?

Mr. TOBIASON. May I show you a piece, sir?

Mr. GLICKMAN. Sure.

Mr. TOBIASON. This is a piece of Norfab. Norfab is a currently available and off-the-shelf material. What we have is a very, very thin layer of material that one applies to a polyurethane seat. Let us take the polyurethane cushion; remove the fire retardant, which is about a third of the weight of the cushion; put that very thin layer of material all around the seat cushion, aluminum side out. The aluminum surface is underneath the upholstery layer, which the passenger, of course, would never see that material. The aluminized surface of the fabric has the job of radiating the heat away from the seat.

If you will turn it over, you will find three principal products used in that fabric: 25 percent Nomex, 70 percent Keflar, and 5 percent Kinol. Those, the fabric underneath supports the aluminum which does the reradiation, both vertically and horizontally, taking the heat away from the urethane. The material underneath helps form a very important char layer which keeps the cushion from outgassing materials which, of course, eventually burn. So by wrapping that material all the way around the seat, we keep the urethane from getting hot, decomposing or pyrolizing, and forming dripping liquids and gases which will combust.

Normally urethane under a fire will melt, drip away under the seat, and form a pool. Of course that pool forms the gases which burn. The burning, of course, causes the walls and ceilings to release gas products which also burn This is called flashover. So the aluminum blocking radiates the heat away, and the material underneath forms a char layer keeping the foam from developing gases, some of which are toxic.

Mr. CARNEY. How long will that perform before you do have the flashover?

Mr. TOBIASON. The best information we have, of course, is from the full scale C-133 work at the FAA Tech Center. If one were to test a normal urethane seat, one would say that lethal conditions occur after a minute and a half. With the fire-blocking layer, one is buying at least another 45 to perhaps 50 seconds additional time, about a 60 percent increase in flashover resistance; or egress time, most importantly.

Mr. CARNEY. You are talking about adding 45 seconds to a minute of egress time before the flashover occurs?

Mr. TOBIASON. To a minute and a half.

Mr. CARNEY. The reason I bring this up, and perhaps this is not the appropriate forum to bring this up but we are still dealing with a very short period of time. We recognize that getting out of the plane can be so much faster when people are educated to the way of getting in and getting out of an aircraft under emergency conditions. There was an accident that occurred where there were professional airline employees on it. And every one, I think it was 133

people on the plane got out and the plane burst into flames later. But they knew how to get out and they had that time frame to get out. So you are buying some more time.

Maybe we also should be putting emphasis on assuring that people can get out faster as well. You are doing your job, but there is more of a job to be done I would think.

Dr. COLLADAY. Yes, sir.

Mr. GLICKMAN. How long does it take to get out of an airplane?

Mr. TOBIASON. You would have to ask the Safety Board because no two people are the same, no two airplanes are the same——

Mr. GLICKMAN. But I assume 45 seconds to a minute and a half will increase by a substantial number the passengers to get out.

Mr. TOBIASON. Yes, sir. It is a solvable problem, when one looks at the combination of advanced seats and panels, which will be tested in about 1 year, the time to lethality should increase to 4 minutes or more, so you are talking about tripling the egress time.

Mr. GLICKMAN. Can you estimate what the timing can be with accelerated effort to arrive at a material specification, process specs, manufacturing, regulation, standards, and four or five different things, one, for fire-blocking seat materials?

Mr. TOBIASON. I think it is safe to say the technical information has been made available. FAA has come up with a test procedure that can relate small and intermediate scale tests with a full C–133 test.

Mr. GLICKMAN. What about self-extinguishing carbon fiber fire wall and furnishings materials?

Mr. TOBIASON. We will, under the agreement with the FAA, deliver the most advanced panels next year. A year from now we will have delivered the most fireworthy and lightweight materials available for testing.

Mr. GLICKMAN. Cabin floor burn through resistant materials?

Mr. TOBIASON. I think the floor burn problem has essentially been determined. FAA has that data. They are doing collaborative testing with the DC–10 test section.

Mr. GLICKMAN. You say the technical problem with the floor burn materials——

Mr. TOBIASON. I think that problem is well understood, as the panels will be a year from now. We are not participating directly in any effort in that area.

Mr. GLICKMAN. You are not. What about antimisting fuels?

Mr. TOBIASON. NASA has completed its support to the FAA with respect to antimisting fuels by identifying what you have to do to jet engines to modify them to be compatible with FM–9 based AMK. That research is now being reported.

Mr. GLICKMAN. From NASA's perspective what else could we be doing?

Mr. TOBIASON. I think the fire-blocking layer concept, of course, is something we can look at within the wall panels themselves between the wall and outside skin of the airplane. I think we have to look at the insulation, bagging, insulation of wiring, and fire barriers within walls you might say.

Mr. GLICKMAN. Are you doing any of this additional work?

Mr. TOBIASON. Yes, we plan starting that this fall.

Mr. GLICKMAN. I just might mention, I understand the FAA regulations require 90 seconds for evacuation time. Is that correct?

Mr. TOBIASON. Sir, that is my understanding, also. But that does not address the complications of fire in crashes.

Mr. GLICKMAN. I realize that, but a 90 second figure would clearly make important contemplate the kind of additional time we are talking about here.

Mr. TOBIASON. Yes, sir.

Mr. GLICKMAN. Mr. Carney?

Mr. CARNEY. Thank you. The chairman clicked off a group of issues and asked you whether the technology now exists. Let me ask you a question. Does NASA have materials that they use in their space program that are on the shelf now that can be put into an aircraft?

Mr. TOBIASON. Could I answer that in a yes or no sense, I guess, because quite frankly we started by looking at fire-blocking layers as a near-term intermediate solution. We would like to have the material that is inherently fire resistant to start with. We did that through the space program.

The genesis of the polyimide foams we developed came from the shuttle program. These foams are very lightweight, probably two-thirds the weight of polyurethane. They are very good fire performers. They resist fire very well. As a rigid foam they are great as insulators. As a matter of fact, that is what they are used for in the shuttle program, to isolate from vibration and heat. For instance, the food is insulated by polyurethane foam in the freezer. Medical trays and equipment are protected from vibration by that foam.

When we tried it as a seat cushion foam, it worked really well as a fire material. But when we tried to work it for comfort and durability and fatigue; it did not work out as the foam was to stiff.

That is the yes and no answer. Yes, there are things we have tried. We have tried to bring them from the space program into aeronautics and it just hasn't worked out. We are still with the idea of trying to do that.

Mr. CARNEY. You mention wiring and that type of thing within the airframe. How much does that add to the toxicity and the fire problem you are dealing with within a cabin?

Mr. TOBIASON. Our perception comes from our work with the military; principally working with the transport people and some of the fighter people in the Air Force. We have been told that some of the electrical wiring insulation, after a few years, becomes embrittled and allows short circuits and fires to start. We have worked with a military team on that. We are looking to see if that is a problem in the civil sector. We have no data base from which to judge that at the moment.

Mr. CARNEY. My final question is one having to do with the interaction between NASA, FAA, airline industry. Are you comfortable and confident that we are doing the best we can to get information from one agency to the other, to get technologies from one agency to the other? Obviously, NASA is the lead agency when it comes to dealing with new technologies. But are we getting these technologies into applied fields other rather than just into the programs supported by NASA.

Mr. TOBIASON. I think, sir, we could be looked on very well here because it is a standard NASA tradition to be involved heavily with industry, airframers, powerplant people, and materials and chemistry companies. I think that is a strength of our program. We all participated on the SAFER committee. NASA was on both the executive and technical committees. We participate closely with the industry, technical societies, ASTM, National Bureau of Standards, all the people we could look to for test methods and procedures because of their involvement with other fire problems in enclosed areas.

We have had grants with universities, contracts with the major airframe manufacturers, and chemical suppliers. It's been a rolled-up sleeves, hard-working group for the last 3 years. We have had periodic meetings and conferences with the industry and the aviation community. To cite a few, we had a very large conference on AMK at the FAA Technical Center in February 1981. The next month we had a large seat conference on fire-blocking layered seats at Johnson Space Center. We have published many reports. The industry, in fact, has taken our reports and reported on them. Aerospace Industries Association has compiled our reports and published a report which speaks very favorably of the fire-blocking layer. So I think, in sum, we have worked very closely with the industry. They have very unique facilities and add the essential requirements for practical use.

The cabin fire simulator at Douglas, some of the test work at Boeing and Lockheed, I think it has been a very well-integrated, well-thought-out and well-organized program over the last 3 years.

Mr. CARNEY. Thank you very much.

Mr. GLICKMAN. Thank you. We appreciate the work NASA has been doing in cooperation with the FAA on air safety. I happen to believe NASA's program is one of the shining lights of R&D programs that this country has. We appreciate the role you are playing to help move aviation safety along.

Dr. COLLADAY. Thank you, Mr. Chairman.

Mr. GLICKMAN. Our last formal witness, though we may have one more after that, is General John Ralph, senior vice president, Air Transport Association of America.

Is Harold Schaitberger here?

Mr. Schaitberger is from the International Association of Fire Fighters, AFL–CIO. After General Ralph is finished, we will invite you up to make a statement if you so wish.

STATEMENT OF JOHN E. RALPH, SENIOR VICE PRESIDENT, OPERATIONS AND TECHNICAL SUPPORT, AIR TRANSPORT ASSOCIATION OF AMERICA, ACCOMPANIED BY E. L. THOMAS, ATA VICE PRESIDENT FOR ENGINEERING MAINTENANCE

Mr. RALPH. Good afternoon, Mr. Chairman.

Mr. GLICKMAN. Feel free to summarize your statement.

Mr. RALPH. Thank you. With me is Mr. E. L. Thomas, vice president for engineering and maintenance. You have a statement for the record. For our purposes Today, I will make a few points for consideration of the committee, then make ourselves available for whatever questions you may have.

The ultimate objective of the National Transportation Safety Board, the Federal Aviation Administration and airlines is the same. That is to deliver the safest transportation possible to the American public. American commercial air carriers operate about 2,800 aircraft and conduct about 14,000 flights carrying 800,000 people a day. We approach our safety responsibility with a profound sense of humility and commitment. We have a deep respect for the role of the NTSB. They meet their responsibility by investigating and reporting on accidents and formulating recommendations they believe will enhance safety.

Their reports and recommendations are given the most serious consideration by the industry. In that regard we appreciate the opportunity to comment on the NTSB recommendations that are related to the FAA service difficulty reports, or the SDR's.

Mr. Chairman, in my prepared statement I develop both a situational and historical perspective which is important in understanding the current context of FAA SDR's. Just let me capture, if I may, the two thoughts that we want to portray there. The first is that any imposed reporting system is only one of the data gathering mechanisms used by the airlines to control its maintenance program. Within each corporation a vast amount of information is collected on a daily basis. This information is shared with the FAA air carrier inspector. Also, there is a daily exchange of information between the carriers, primary aircraft manufacturers, vendors, and the FAA.

The second major theme that I would like to capture from our discussion on perspectives, is that one of the dilemmas, and I must say we don't have a solution to the dilemma, but nevertheless, one of the dilemmas of reporting systems is that quite often there is an impetus or a thrust to collect more and more data, and the system runs the risk of becoming cluttered with information that may be interesting, but ancillary and noncritical from the safety point of view.

The problem that grows out of this phenomena is that an overabundance of data may act to hide or submerge those few important bits of information of true safety significance thereby frustrating the very safety objectives the program was designed to accomplish. So with those two perspectives, I will next try to capture for you some of the things industry does which are designed to satisfy many of the objectives that have been expressed by the NTSB in its current recommendations.

In the development of the initial maintenance program for new aircraft, the airlines and manufacturers have developed an airline manufacturer's maintenance planning document. This is done by the Maintenance Steering Group. Their work has progressed from an MSG-1 used on the 747 to MSG-2 used on the DC-10, L-1011 and A-300, and indeed used retroactively on some other aircraft, MSG-3, published first in October 1980, was first used on the 757 and 767 aircraft which have currently entered the inventory.

FAA has participated in the development of these documents, and the use of these documents for initial maintenance program development has been long accepted by FAA. Each document has been progressively modified and made more comprehensive than the previous version. The document is used by an industry commit-

tee for each airplane type along with a number of industry working groups to develop the initial maintenance program for new aircraft for consideration by the FAA Maintenance Review Board. This information has proved to be useful. However, FAA reserves for itself, and rightly so, responsibility for review of the maintenance program.

Between issuance of the MSG-2 and -3, FAA developed new rules for damage tolerance and fatigue evaluation of aircraft structures. Building on this and other industry experience MSG-3 included a requirement covering accidental damage. The possible sources of which include improper maintenance and/or operating procedures. Each structurally significant item must have an accident damage rating. There must be an environmental damage rating and a fatigue damage rating all of which are used in establishing the initial maintenance program.

On the 757 and 767, accidental damage rating is based on sensitivity to damage size, residual strength after damage, and likelihood of accidental damage occurring. Assessment of these factors is based on knowledge of the airplane design, maintenance methods, and prior experience. The initial maintenance program develops the maintenance tasks which should be done, and the manufacturer in cooperation with airline customers develops the method of accomplishment. As experience is gained on the airplane, operators can and do develop more effective methods of achieving reliability and safety objectives.

Many of these methods are developed by the airlines, and are ultimately adopted and published by the manufacturer for the use of other operators. We believe these actions satisfy many of the purposes the NTSO recommendations hope to accomplish.

In closing, let me turn to the aviation safety analysis program. I have already identified this one major dilemma, that is to say, that reports with an overabundance of data may act to hide or submerge those few important bits of information of true safety significance. While we concur with the objectives of the safety analysis system, we believe simply inputting into that system the service difficulty reports as presently constituted need to be looked at.

We believe a decision needs to be made, whether the objective of the program is as an alerting device, which we certainly believe is most important, or as a statistical gathering device, or both. Then the question of how one should fashion the input data to serve those two purposes needs to be answered. To this end, we have established in the Air Transport Association a task force of our member airlines to develop recommendations for the FAA's consideration.

We are aware the FAA has a large stake in the aviation safety analysis system, and they want it to be successful. The airlines share in this hope for success. And the airlines are very desirous that the alerting function of ASAS not contain a proliferation of extraneous data to the point where it becomes unmanageable or unusable for this important safety function.

In closing, again, let me state the Federal Aviation Administration, the NTSB, and the airlines all share in the ultimate objective of providing the very safest air transportation known to man. We

recognize these different institutions may have differing views on how best to accomplish that ultimate safety objective.

We appreciate the committee giving us the opportunity to state our views on the issues at hand. Thank you, Mr. Chairman.

[The prepared statement of Mr. Ralph follows:]

Statement by John E. Ralph
Senior Vice President - Operations and
Technical Support
Air Transport Association of America before
the Subcommittee on Transportation, Aviation
and Materials of the U. S. House of Representatives
Committee on Science and Technology
June 27, 1983

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

My name is John E. Ralph. I am Senior Vice President - Operations and Technical Support of the Air Transport Association of America (ATA), which represents U. S. scheduled air carriers. I am accompanied by E. L. Thomas, ATA Vice President for Engineering and Maintenance.

INTRODUCTION AND OVERVIEW

Safety of flight operations has been and will always continue to be the paramount concern of the airline industry and all its people. In that regard, the ultimate objective of the airlines, the Federal Aviation Administration and the National Transportation Safety Board is the same: to deliver the safest air transportation possible to the traveling public.

Whereas our ultimate objective is assuredly the same, the three institutions -- the airlines, the FAA, and the NTSB -- come by this ultimate objective from different points of departure. The airlines are charged by law to operate commercial air service at the highest level of safety. American commercial air carriers conduct approximately 14,000 flights carrying about 800,000 people a day. We approach our safety responsibility with a sense of profound humility and a deep sense of commitment. The Federal Aviation Administration is charged not only with regulatory responsibility, but also with the day-to-day operations of the air traffic control system. Their responsibility is to insure that the total environment for air

travel, including equipment, people and procedures, is as safe as it can possibly be. The National Transportation Safety Board's responsibility is to investigate accidents and incidents and based upon their analysis to recommend actions they believe will enhance safety. We have a deep respect for the role of the NTSB. Their conduct of investigations has gained for them a world-wide reputation for professionalism and objectivity. Their reports and recommendations are given the most serious consideration by the industry.

In that regard, we appreciate the opportunity to appear before the subcommittee to comment on NTSB recommendations regarding the FAA's Service Difficulty Report (SDR) System and on related maintenance safety matters as requested in the Chairman's letter of June 3, 1983.

The eight NTSB recommendations for discussion are numbered sequentially from A-79-98 through A-79-105. A-79-98 dealt with certification procedures and its status has been recorded as "closed - acceptable action" by the NTSB. A-79-99 dealt with design requirements and the NTSB is maintaining this recommendation in an "open-acceptable action" status. The last NTSB recommendation in this series, A-79-105 dealt with operational procedures and was recorded "closed - acceptable action" by the NTSB. Since these three items are not related to the SDR system we will confine our remarks to the remaining five -- A-79-100 through A-79-104.

In discussing these recommendations I shall proceed along the following lines. First, I shall develop both situational and historical perspectives on the current Service Difficulty Reporting System and the FAA's follow-on Aviation Safety Analysis System (ASAS). Secondly, I shall comment on the three NTSB recommendations that are directly related to the FAA's SDR system; A-79-100, 103 and 104. I shall then

briefly comment on the remaining two recommendations, 101 and 102, which are closely related. Finally, in my concluding remarks I shall highlight an item of continuing concern the industry has about data reporting systems.

PERSPECTIVES

In order to place the SDR system into a situational context it is important to realize that the SDR system is only one system used by the airlines for getting information on service difficulties. In its own maintenance program, an air carrier collects significant amounts of data on its equipment as it monitors around-the-clock the safety status of its equipment and the effectiveness of its maintenance program. This data is made available to the assigned FAA inspector for use in maintaining surveillance over the airlines. Because of the sheer bulk of this data, and its individual tailoring designed to help an airline in the management of its maintenance program, it is not adaptable for use on an industry-wide basis.

Every airline maintenance program is designed to detect and correct potential failures or malfunctions before they reach proportions which would involve the safety of the airplane. The fact that failures, malfunctions and difficulties are found and corrected is an indication of the effectiveness of a good maintenance program. Failures, malfunctions, and difficulties only become significant if a mechanical incident occurs unexpectedly or goes beyond established limits. Such incidents may result in a change to the maintenance program, and notification of the manufacturer and the FAA.

Also, manufacturers have large product support organizations, which continuously monitor the status of all of their airplanes on a world-wide basis.

Most prime manufacturers have representatives stationed at airline maintenance bases, who feed information to their companies. Airlines are also in direct daily contact with the manufacturers on any problem that may rise. The manufacturers constantly advise operators of their aircraft of problems found by other operators and issue service bulletins and other service information to correct or alleviate problems. Most information is of a product improvement nature and will lead, in priority importance, to increased reliability of operation or reduced costs. Information of a safety nature is handled expeditiously and may lead to the issuance of an FAA Airworthiness Directive.

We have been following the development of the FAA's Aviation Safety Analysis System (ASAS) since the industry was first briefed in November 1979. We were aware that FAA was considering the SDR system as a building block for ASAS although it was only one of the many safety data bases being considered by FAA for inclusion in ASAS. We expressed reservations to FAA at that time concerning the inclusion in ASAS of the SDR's in their present form because of the very extensive non-critical information they contained. ATA has had an ASAS Task Force for some time which has been monitoring the overall ASAS program, and ATA and the airlines have received periodic progress briefings. FAA has expended considerable time and effort in the development of the mechanics and hardware of the ASAS program. We believe they were right in doing so, and hope that further refinements will be made.

To assist the Committee in its important work we believe it is appropriate at this point to place the development of the mandatory reporting of service difficulties in historical context. The Air Commerce Regulations of 1926 in Sec. 57 required that:

> "The owner or operator of every licensed aircraft shall keep a navigation and engine log book and shall quarterly transmit to the Secretary of Commerce a navigation summary report, in duplicate, showing the number of hours and the approximate number of miles the aircraft has flown during the quarter, the duration of the use of each engine, the engine installation and repairs, and the plane structure and rigging changes and repairs".

In 1948 the Civil Aeronautics Administration (CAA) first required a Daily Report of Mechanical Hazards and a Monthly Report of Mechanical Difficulties. These requirements were delineated in Sections 61.90 of the Civil Air Regulations. The items to be reported daily were described in broad, objective terms. The monthly reports required specific reporting of items which could be used to determine the mechanical reliability of the aircraft and its components, such as hours flown, mechanical hazards per 1000 hours of operations, unscheduled removals and repairs per 1000 hours. The daily reports were a means of alerting government and industry to potential hazards. The monthly report was in the nature of a how goes it report on mechanical reliability.

These 1948 regulations evolved into two requirements which were effective until 1962. The requirements were:

1. Daily Mechanical Reports (DMR)

> "Whenever a failure, malfunctioning, or other defect is detected in flight or on the ground in an airplane or airplane component which may reasonably be expected by the air carrier to cause a serious hazard in the operations of any airplane, a report shall be made of failure, malfunctioning or other defect to the Administrator. This report shall cover a 24 hour period beginning and ending at midnight, shall be submitted by 12 o'clock midnight of the following working day, or sooner if the seriousness of the malfunction or difficulty so warrants...."
> (Emphasis added)

2. Mechanical Interruption Summary Report (MISR)

"Each air carrier shall submit regularly and promptly to the Administrator a summary report containing information on the following occurrences:

(a) All interruptions to a scheduled flight, unscheduled changes of airplanes enroute, and unscheduled stops and diversions from route which result from known or suspected mechanical difficulties or malfunctions.

(b) The number of engines removed prematurely because of mechanical trouble, listed by make and model of engine and the airplane type in which the engine was installed.

(c) The number of propeller featherings inflight, listed by type of propeller and type of engine and the airplane on which the propeller is installed. Propeller featherings accomplished for training, demonstration, or flight check purposes need not be reported".

The airlines found the DMR's useful as an "alerting" device, calling to their immediate attention problems encountered by other operators of similar equipment. The airlines reviewed these reports on a daily basis and utilized them in their daily maintenance briefings. The MISR's were useful to the assigned FAA inspector in maintaining surveillance of the airline by providing a continuing check on mechanical reliability.

In 1960, FAA proposed changes to strengthen the uniformity of reports, and in 1962 adopted the rules which are essentially in effect today. In the preamble of its proposed change, FAA stated: "The foremost objective of a reporting system is to warn industry and government of incidents of an 'alert' type which may be common to aircraft, systems or components of the same or similar type". The airlines heartily subscribed to that objective, and continue to believe it has great merit in enhancing safety.

It should be noted, however, that there were two major differences in this rule and the previous rule: First, the previous wording which required reporting of items "....which may reasonably be expected by the air carrier to cause a serious hazard in the operation of any airplane...." was deleted; and second, the air carrier was required to submit reports on 16 specific items, and a broad requirement was added which called for the reporting of any other item which, in the opinion of the air carrier, has endangered or may endanger the safe operation of the aircraft.

As a consequence of these changes, the number of reports increased dramatically -- so much that, in the opinion of the airlines, the reports had diminished significance as an "alerting" device and had become cluttered with much subsidiary or non-critical information which was not particularly useful for that purpose. This problem persists and we shall have additional comments on the problem of separating "wheat from chaff" in the interest of improved safety. Further since the reporting requirements had not been designed to gather data for statistical analysis, they were not very useful for that purpose either.

In 1968 - 1969, the airlines working with FAA developed a trial program which extended over a 9 month period and involved 9 airlines. This trial program was titled, "Mechanical Alert Report (MAR) and Mechanical, Irregularity Summary Report (MISR)". In the MAR program, the airlines resumed the system of reporting on problems that in the opinion of the air carrier were of safety importance and should be reported. The guidelines of the type of items to be reported were similar to the list in the 1962 regulation with some additions and deletions. For the more important circumstances, reports were required by telephone to FAA and the prime manufacturer. The MISR was designed as a statistical reporting system and required monthly reports.

The airlines felt that the trial program was a success. It reduced the number of items reported in the MAR program significantly, thereby focusing attention on the important events, which were those of value for safety alerting purposes. The airlines proposed that the program be expanded to cover all airlines, but FAA did not agree. While never officially advised of FAA's opinion of the trial program, it is our understanding that some FAA officials wanted more information for reasons not made clear to us.

Since that trial program of 1968 - 1969, FAA has embarked on projects from time to time to revise the requirements, but these projects never come to fruition. Periodically, various parties propose additional items to be added to the existing list of required items. These proposals should be examined carefully because there is a valid need to assure that they do not further clutter up the program and have further adverse effects on the usefulness of the alerting program. A serious problem which is not always recognized is that an over-abundance of data may act to hide or submerge those few important bits of information of a true safety significance, thereby frustrating the safety objectives of the program.

With these perspectives in mind, we have reviewed the NTSB recommendations A-79-100, A-79-103 and A-79-104 as well as the exchange of correspondence between FAA and NTSB on these recommendations and offer the following comments.

NTSB Recommendation A-79-100

> Initiate and continue strict and comprehensive surveillance efforts in the following areas:
>
> (a) Manufacturer's quality control programs to assure full compliance with approved manufacturing and process specifications; and,
>
> (b) Manufacturer's service difficulty and service information collection and dissemination systems to assure that all reported service problems are properly analyzed and disseminated to users of the equipment, and that

appropriate and timely corrective actions are effected. This program should include full review and specific FAA approval of service bulletins which may affect safety of flight.

COMMENT

NTSB has concluded that FAA's action in regard to (a) above is satisfactory so no additional comments are required. With respect to (b) above, we believe the expanded explanation of what the FAA will be doing in developing the ASAS in the FAA letter of May 27, 1983, is responsive to this item. We do not interpret FAA's remarks as a rejection of NTSB recommendations, but rather that FAA will consider them in developing ASAS. Page 3 of the FAA letter says, among other things:

"In developing this system consideration will be given to the data presently collected, the sources of information, the methods of collection, use of the data within FAA, and the dissemination of information derived from the system. If in considering these factors, changes in regulations or FAA internal procedures are indicated, such changes will be implemented".

We believe the FAA should have the opportunity to demonstrate that the ASAS system will meet the safety needs of the aviation community.

NTSB Recommendation A-79-103

Revise 14 CFR 121.707 to more clearly define "major" and "minor" repair categories to insure that the reporting requirement will include any repair damage to a component identified as "structurally significant".

COMMENT

The NTSB is carrying this item as "open - unacceptable action", because the FAA has withdrawn a proposal, Notice 81-10, which attempted to address this issue.

The problem of the definition of "major" and "minor" repair categories is one of long standing. No matter what regulatory wording is selected, it will not replace the exercise of sound engineering judgment in deciding what is "major". As stated in FAA Order 8110.37, Designated Engineering Representative (DER) Guidance Handbook, "In many cases, a clear-cut line of demarcation between major and minor items is extremely difficult. Opinion contributes much to the resulting determination. The prime consideration is that airworthiness is not compromised rather than assigning the proper classification to the item".

The airlines believe the FAA took the correct action when it withdrew this proposal for the reasons set forth in FAA's letter of October 5, 1982 to NTSB. Subsequent to the withdrawal of this proposal, and at the urging of FAA, an industry Task Force was established to tackle the subject. In addition to ATA, the following organizations are participating:

Aerospace Industries Association
Aircraft Electronics Association
Airline Services Association
General Aviation Manufacturers Association
Helicopter Association, International
National Business Aircraft Association
Professional Aviation Maintenance Association

This membership reflects the full range of aviation experience from general aviation to air carrier, both operators and manufacturers. We believe we have a consensus on a number of proposed regulatory changes and advisory circular proposals which will be submitted to the FAA in the near future.

Since FAA has public regulatory responsibility, it will have to rework the Task Force recommendations into regulatory proposals which will then be published for public comment. Final disposition of this item must remain open until these additional proposals are considered.

NTSB Recommendation A-79-104

Expand the scope of surveillance of air carrier maintenance by:

(a) Revising 14 CFR 121 to require that operators investigate and report to a representative of the Administrator the circumstances of any incident wherein damage is inflicted upon a component identified as "structurally significant" regardless of the phase of flight, ground operation, or maintenance in which the incident occurred; and,

(b) Requiring that damage reports be evaluated by appropriate FAA personnel to determine whether the damage cause is indicative of an unsafe practice and assuring that proper actions are taken to disseminate relevant safety information to other operators and maintenance facilities.

COMMENT

It appears that NTSB has classified the actions of FAA as "closed - unacceptable action", because the FAA has failed to take regulatory action.

The comments that we have made with respect to A-79-100 apply here. It appears to us that due regard will be taken of NTSB's recommendation in the development of the ASAS system. Again, we believe the ASAS should be given an opportunity to demonstrate that it meets the safety needs of the aviation community.

Having commented on those NTSB recommendations directly related to FAA's SDR system, let me now offer a few brief remarks on the remaining two recommendations.

NTSB Recommendations A-79-101 and A-79-102

(101) - Assure that the Maintenance Review Board fully considers the following elements when it approves an Airline, Manufacturer Maintenance Program:

(a) Hazard analysis of maintenance procedures which involved removal, installation, or work in the vicinity of structurally significant components in order to identify and eliminate the risk of damage to those components;

(b) Special inspections of structurally significant components following maintenance affecting these components; and,

(c) The appropriateness of permitting "on condition" maintenance and, in particular, the validity of sampling inspection as it relates to the detection of damage which could result from undetected flaws or damage to structurally significant elements during manufacture or maintenance.

(102) - Require that air carrier maintenance facilities and other designated repair stations:

(a) Make a hazard analysis evaluation of proposed maintenance procedures which deviate from those in the manufacturer's maintenance manual and which involve removal, installation, or work in the vicinity of structurally significant components; and,

(b) Submit proposed procedures and analysis to the appropriate representative of the Administrator, FAA, for approval.

COMMENT

Since these two recommendations are similar in nature, and have been treated together in the exchange of correspondence between FAA and NTSB, we will comment on them together. First of all, we would note that FAA, in its letter to NTSB of March 20, 1980, pointed out that the Federal Aviation Act, Section 601(b) reflects, "the duty resting upon air carriers to perform their services with the highest possible degree of safety". Further, as indicated in that letter, FAR 121.363 assigns the specific responsibility to the air carrier for the continuing airworthiness of its aircraft, and FAR 121.373 requires the air carrier to make continuing analysis of its maintenance program. Moreover, in its letter to NTSB of June 10, 1981, FAA stated, "It has been our observation that the air carriers, because of operational experience not held by the manufacturers, know more about how to maintain their aircraft than do the manufacturers". While we agree with these comments made by FAA in the referenced letters, we feel it appropriate to offer additional comments about joint industry/FAA efforts.

In the development of the initial maintenance programs for new aircraft, the airlines and manufacturers have developed an Airline/Manufacturer Maintenance Planning Document. This has progressed from MSG-1 (Maintenance Steering Group) which was used on the 747, to MSG-2 which was used on the DC-10/L-1011, A-300, (and used retroactively on other aircraft as well), to MSG-3 which was published in October 1980 and first used on the 757 and 767 aircraft.

FAA has participated in the development of these documents, and the use of these documents for initial maintenance program development has been long accepted by the FAA. Each document has been progressively modified and made more comprehensive than the previous version. The document is used by an Industry Steering Committee for each airplane type, along with a number of industry working groups, to develop the initial maintenance program for new aircraft for consideration by the FAA Maintenance Review Board for approval. FAA participates in these industry activities in an observer capacity and this participation has proven to be very useful. However, the FAA reserves to itself, and rightly so, the complete responsibility for review and approval of the initial maintenance program.

Between the issuance of MSG-2 and MSG-3, FAA adopted FAR 25.571 which established new requirements for damage tolerance and fatigue evaluation of aircraft structures. A companion advisory circular AC 25.571-1 was also issued. Building on this and other industry experience, MSG-3 included a requirement covering "accidental damage", the possible sources of which include "improper maintenance and/or operating procedures". Each structurally significant item (SSI) must be given a fatigue damage rating, an environmental damage rating, and an accidental damage rating, all of which are used in establishing the initial maintenance program. On the 757/767 the accidental damage rating is based on sensitivity to damage size and/or growth, residual strength after damage, and likelihood of accidental damage. Assessment of these factors is based on

knowledge of the airplane design, maintenance methods used and prior experience.

The initial maintenance program develops the maintenance tasks which should be done and the manufacturer, in cooperation with the airline customers, develops the method of accomplishment. As experience is gained on the airplane, operators can and do develop more effective methods of achieving reliability and safety objectives. Many of the methods developed by the airlines are ultimately adopted and published by the manufacturer for the use of other operators.

The expertise existing in the airlines represented by the tens of thousands of mechanics and engineers directly involved in air carrier maintenance cannot be matched by the manufacturer or the FAA. Nor can an airline's ultimate responsibility be shifted. The FAA will most certainly continue its surveillance of air carrier activity as well as that of the manufacturers, and we, therefore, do not believe that safety would be enhanced by adoption of these two recommendations.

CONCLUDING REMARKS

In closing I would like to return to a problem area that seems to have persisted throughout the history of safety reporting systems. In my discussion of perspectives I indicated that a system of reports with an over-abundance of data may act to hide or submerge those few important bits of information of true safety significance, thus frustrating important safety objectives. While we concur with the objectives and intent of ASAS, our previously expressed concerns about SDR's as required by FAR 121.703 remain. Simply inputing what is now in 121.703 into ASAS will not improve the reporting of safety important items. A decision needs to be made whether the objective of the program is as an alerting device or a statistical gathering device or both, and how the input data should be specified to accomplish the objective. To this end, we have established an ATA Task Force from our member airlines to develop recommendations for FAA's consideration. We are aware FAA has a large stake in ASAS and they want it to be successful. The

airlines share in this hope for success and are very desirous that the alerting function of ASAS not contain a proliferation of extraneous data to the point where it becomes unmanageable or unusable for this important safety purpose.

It should be pointed out that ASAS cannot supplant, but hopefully it will usefully supplement, the vast network of exchange of information between airlines and between airlines and manufacturers which I have discussed earlier. Many times a simple telephone call, which usually can be made any time of the day or night any day of the week, is enough to identify a problem and result in a solution. Safety information must be shared information, and we hope that ASAS will make a positive contribution to the timely sharing of critical safety information.

Finally, let me restate my opening theme. The Federal Aviation Administration, the National Transportation Safety Board, and the airlines all share in the ultimate objective of providing the very safest air transportation system known to man. We recognize that different institutions may have differing views on how best to accomplish the ultimte safety objective. We appreciate the Committee giving us the opportunity to use this forum to state our views on the issues at hand.

This concludes my statement, we are now ready for your questions.

Mr. GLICKMAN. Thank you, General Ralph.

I want to ask you a couple of questions on the fire aspects we talked about today. It wasn't in your testimony. I assume you have no objection.

Mr. RALPH. No, none at all.

Mr. GLICKMAN. How long would it take the air carrier fleet to install new, less flammable fire-blocking layer seat materials?

Mr. RALPH. I can't give you a definitive answer on that. The materials are available. Both FAA and NTSB have made that clear today. We are pleased such is the case. Specialty vendor manufacturers are going to have to make use of those materials, to design the seat, the production of the materials will have to get underway. I am not well-informed on the ability of the various specialty manufacturers to provide quantity production. Just among ATA members alone we have about 400,000 seats in our inventory. So we are not talking about an easy task. We are concerned as to how we can accommodate that large number.

We look forward to seeing what the proposed rule will be. Our hope that it will be cast in terms of something that is realistically doable in terms of the industrial process that will have to be undertaken to accomplish this.

Mr. GLICKMAN. But you are not going to fight the implementation of some rule which would require that fire-resistant seats be put in aircraft, are you?

Mr. RALPH. Let me preface my remarks by saying that the aviation community was a strong supporter of the SAFER Committee actions that have already been referenced by the NASA witness. Specifically, on the fire-blocking seat material we were a party to those recommendations. I would expect the concern of the industry will only be on its doability, and not any other consideration.

Mr. GLICKMAN. Let me ask you, you represent all the carriers. We have talked a little bit today about the financial ability of carriers and whether that is having an effect on aviation safety. Let me ask you that question directly. Are the current financial problems of some of the carriers and the effect of a whole bunch of new carriers coming into existence through the deregulated environment having an effect on aviation safety?

Mr. RALPH. I can't speak for all of the new carriers. Some are our members. As a result we communicate with them and know their status. I don't believe that the economic status of our members affects their maintenance quality. I believe that you cannot market an unsafe airline. In today's environment, one of the most important capabilities that the airline industry has found that it must have in order to respond to market demands is a very, very reliable schedule in order to engage in what are called hub and spoke operations.

This requires very, very close timing between arriving and departing aircraft at their hub operations. Now, you can't perform that kind of an operation with aircraft that are mechanically unreliable or unsafe. Contrary to what I think is the popular mythology, that deregulation has led to a lesser level of safety, I think that deregulation and the establishment of new patterns of service by the traveling public require safer operations.

Mr. GLICKMAN. Recently I flew on a carrier, I won't mention the carrier, but the pilot was very comforting because he was on several times. He says, you are flying on the safest airline that flies today. Now, I assume other carriers and other pilots might challenge that, but I guess it was comforting to me, because as one person who flies all the time, there is nothing more important to me than the issue of safety. Nothing. What meals you serve, how you paint your planes, or any of these other collateral matters. And I would tell you that as long as I am chairman of this committee, that will be my focus in terms of the legislative mandate we have.

Mr. RALPH. And safety is truly our highest objective.

Mr. GLICKMAN. Thank you.

Mr. Carney.

Mr. CARNEY. Thank you, Mr. Chairman.

Thank you, General.

I would like to get back to a problem that we did not give much attention to, only because the other issues were of such great importance. But that is the passenger. You represent the airlines, so you are probably closer to the passenger than the FAA and certainly closer to the passengers than NASA and some of those other agencies.

How much more can we enhance the safety of the airline industry by having a better passenger?

Mr. RALPH. A difficult question. It would be helpful if all the passengers would listen to the emergency briefings that are given by the flight attendants. It would be helpful, if when passengers boarded the aircraft, that they looked around the cabin and acquainted themselves with the emergency exits. There is a passenger information card in the back of every seat which has a diagram.

Mr. CARNEY. General, you fly a lot, I assume; right?

Mr. RALPH. Yes.

Mr. CARNEY. When was the last time you read one? I don't mean to put you on the spot. But if we asked that of everyone in the audience, we would all come up a little embarrassed, including myself.

Mr. RALPH. My answer is going to be a little unfair, because I check to see if those things are really there. By and large, I look at them every flight I take.

Mr. CARNEY. I am always fumbling to make sure that the bag is there.

Mr. RALPH. Yes. I am also one of those boring people that always looks at the airline magazine, because I read their editorial pages and see what they are saying. So my response is not perhaps valid to your question. But I do look at that.

Mr. CARNEY. I think the point is, though, that we are not getting the message across to the average passenger: how important it is for he or she to be cognizant of the proper safety measures to take. I ask that of you because you are closest to the passenger.

What can be done to get them to look at the safety cards? What can——

Mr. RALPH. Well, the kinds of things I would do myself, I can't speak for passengers, and it is a little bit unfair, I think, to put me

in that position. But I would speak only for myself. I don't think that I would smoke heavily nor drink heavily on an airplane.

Mr. CARNEY. Another question I was going to bring up, the question of alcohol on airplanes. We all know that the altitude and alcohol don't mix very well. It is probably a combination that accelerates the effects of alcohol.

Does that have any effect on safety?

Mr. RALPH. I haven't——

Mr. CARNEY. I will lose all my friends on the 6:30 flight on Friday.

Mr. RALPH. Yes. I am not an abstainer myself. I am not a preacher. I don't recall reading in NTSB reports that this has been a significant item. When I was speaking, I was speaking only for myself.

Mr. CARNEY. I think you were in the audience when they were going through some of the differences between the two information systems, how one will enhance the other. I had the same concern you did about having so much information that it becomes burdensome and clouds some of the information that is indeed important.

Could you make any suggestion as to what types of information you would think would be less important?

Mr. RALPH. I think it needs further study. The difficulty with SDR's is that there is a single reporting system that is apparently—I say apparently because we are not really sure what all the purposes are that FAA uses the data for—but apparently it is used for a variety of purposes.

Perhaps one mechanism out of this dilemma would be to identify the objectives very carefully, and then to tailor the reporting for those objectives. For example, when I use the word "alerting," I am using that for the purpose of drawing attention to other operators that, here is an item that one ought to be alerted to that has important safety significance. I think that kind of system needs to be a very sparse system. Only the most important information that has a potential for significant safety impact should be included.

Now, I don't deny that there is a need for trend analysis based upon long-term data gathering, statistical analysis. That objective needs to be served with a stream of data flow that is specifically identified for that purpose. We run into difficulty when we try to mix those two. That is the only suggestion at this time that I would have; that we clearly define in ASAS what purposes we are to serve and that the data streams designed to feed those purposes be very carefully tailored. We would like to work with the FAA in that purpose. That is why we have put together a task force.

Mr. CARNEY. Are they working with that task force?

Mr. RALPH. No. We have just started.

Mr. CARNEY. Do you expect their cooperation?

Mr. RALPH. Yes, I am sure.

Mr. CARNEY. Those are the only questions I have of you, General. I thank you very much for your testimony.

Mr. Chairman?

Mr. GLICKMAN. One final question: After you have finished, I am going to ask a representative of the International Association of Fire Fighters to present his statement. I believe they had either a news conference or some form of public statement last week in

which they charged that the airlines are unwilling to spend the money to improve fire safety.

I wonder if you would comment on that?

Mr. RALPH. I can only comment on what I have read. I must say that I don't agree with that. Both FAA and NASA have reported this morning that one of the challenges is getting reliable data from testing in order to establish standards and specifications that are based upon the science related to the problem. And that has been our concern. We want to have rulemaking based upon the science associated with the area of study.

It appears that NASA and FAA R&D programs are maturing to that point. I can assure this committee that when there is a demonstrated safety improvement based upon the evidence that is available, the airlines will support that improvement:

Mr. GLICKMAN. Thank you, General, very much.

Now we welcome Harold Schaitberger.

STATEMENT OF HAROLD A. SCHAITBERGER, DIRECTOR OF LEGISLATION, INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

Mr. SCHAITBERGER. Thank you, Mr. Chairman.

First, let me apologize for not having a statement prepared for the committee, or copies. We were only extended the invitation to participate at 10 minutes after 9 this morning. I hope that you would also bear with me. I have tried to put together some areas of concern that we are seriously looking into. I will try to run through those areas; then address any questions you may have.

First, and foremost, the International Association of Fire Fighters, is concerned with why the FAA has been slow in furthering their enhancement toward aircraft safety regulations, particularly in the following areas: in aircraft interiors, smoke detection systems; crash rescue manpower and training; firefighter protective clothing; firefighter respiratory protection and extinguishing agents.

While the publics attention has recently been focused on the airplane fire problem as a result of the recent Air Canada tragedy and other smaller incidents, the problem is not a new one. Ten years ago, in 1973, an aircraft made an emergency landing in Paris after a fire in a plastic wastebasket near the lavatory was discovered. Despite a safe, successful landing, some 124 people died from inhaling toxic fumes given off by the burning synthetic materials used in the aircraft's interior.

While the FAA begins its slow movement in issuing regulations to enhance fire safety of interiors, it is also considering taking action that could further jeopardize the safety of aircraft passengers during an emergency situation. Federal Air Regulations part 139 sets out airport certification standards for assuring safety in air transportation, including the operation and maintenance of adequate firefighting and rescue equipment. These standards are a bare minimum falling far below requirements for fire safety established by the National Fire Protection Association and the International Civilian Aviation Organization.

The FAA, considering that changes in part 139 might be necessary, contracted with H.H. Aerospace Design Co. to develop a sug-

gested method of improving airport certification standards in the most effective way. The H.H. study, among its recommendations, made two that we take strong issue with.

They are, one, elimination of emergency equipment requirements at index A, AA, and D airports; and two, no provision of fire protection for commuter airports. These recommendations to eliminate fire crash rescue are in complete conflict with the International Civilian Aviation Organization and NFP standards accepted by all internationally recognized experts in the field.

There are several basic problems with the H.H. study recommendations deriving from inappropriate data selection and inappropriate assumptions. They are, one, the study was limited exclusively to U.S. aviation activity; a worldwide point of view would have been more realistic in light of the fact that in many cases accidents outside the United States involve American aircraft, personnel, and passengers. Two, of the 628 accidents studied from 1966 through 1978, 221 were estimated to involve actual or potential crash injury or death by impact or fire. Excluding midair crashes, 16.5 percent of the 221 accidents occurred at A, AA, and D airports—the very airports where elimination of crash fire rescue service have been recommended.

It is hard to understand what criteria was used in this decision. However, after careful study, it becomes evident that the presence of an actual fire was the principal factor considered. Contrary to its original purpose, the H.H. study was focused on cost benefit, thus inferring that crash fire rescue was a burden on the airport operator. Effective interior firefighting are also hindered by the fact that the FAA has not kept up with equipment and clothing for the firefighters.

There is no national standard for equipment. As a result, varying protection is afforded firefighters depending upon which airport they serve. Many current protective garments are currently made of asbestos, which poses a cancer risk to the firefighters, even though safer material such as aluminized Teflar are now readily available. I believe you saw a piece of that earlier.

Likewise, there is no FAA requirement for firefighters to wear self-contained breathing apparatus and, as a result, it is not usually furnished. Firefighting and rescue efforts in the interior of an aircraft are thus severely limited due to smoke and other toxic products of combustion produced by the burning of synthetic materials present in aircraft interiors. Furthermore, most firefighting protective clothing is not designed to interface properly with the breathing apparatus now on the market.

Additionally, we are very concerned about extinguishing agents touched upon today. Concerning extinguishing agents, there are four common types of hand-held units on board aircraft today—CO_2, dry chemical, water, and Helon 1211. Presently, there are problems associated with each of these extinguishing materials.

For example, CO_2 is not particularly an effective extinguishing agent in limited supply, particularly against class A fires which are your normally regular burning materials. Helon 1211 is effective at extinguishing all classes of fire, but when heated it in itself decomposes into toxic chemicals like hydrogen chloride, free chlorane, hydrogen fluoride and free bromide and hydrogen bromide, 1211 has

been shown to cause essential nervous system effects, including tremors, convulsions, unconsciousness, and cardiovascular effects including hypotension, decreased heart rate, and occasional cardiac arrhythmia. It can also be lethal.

Recently, last week, it was reported by attorneys for the deceased that a firefighter outside of Tucson died while using a proximity suit and, at the same time, the vapors from the Helon 1211 gathered in the firefighter's hood. Flight crews are trained to utilize coffee and other liquid substances on board to extinguish fires in the insipient stage.

We believe the FAA should begin more extensive research into the investigation of extinguishing agents that are both effective and nontoxic. Additionally, FAA should issue regulations with upgrading the capacity and number of portable extinguishers aboard aircraft.

Now, toward the question of interior materials, one of the largest problems in aircraft fires, as mentioned, is due to the toxic gases and smoke that result from burning cabin interiors, including seats, panels, carpet, insulation, and carryon baggage. This is highlighted by the fact that 80 percent of all deaths during an aircraft fire result from toxic gas and smoke inhalation—not burns. It should be noted that seats alone now account for most of the combustibles onboard. And in a 300-seat aircraft, this would account for 2,400 pounds of potential combustible materials.

Use of less flammable and fire-resistant seating materials would go a long way. We only think that more time has gone by than necessary to cause the implementation of these materials.

Mr. GLICKMAN. Mr. Schaitberger, could we ask you to summarize in a couple minutes, if possible?

Mr. SCHAITBERGER. Fine.

The last point I would then make would be on the detection devices. In most cities, fire-detection devices are required in public facilities. Some even require contractors to use them in residences. These may cost as low as $10 or $12. Yet, they are still not required in aircraft passenger cabins or lavatory areas.

I guess I would simply conclude by saying we applaud the FAA, NASA and any other organization that conducts research. We only think that there has been enough research conducted to date to have caused implementation of some of these standards much earlier than now seems to be the case.

Mr. GLICKMAN. Let me ask you this question: Now the FAA has come here today. You have heard them?

Mr. SCHAITBERGER. Yes.

Mr. GLICKMAN. They have said they are going to begin the rulemaking process on fire-resistant materials in seats. What else do you think they are ready to move ahead on ruling making-wise?

Mr. SCHAITBERGER. I can't imagine why they would not be ready to move on smoke-detection or fire-protection devices. I really think their answer today was totally inappropriate. To suggest their focus is going to move away from detection and more concern with the cause of fire to us seems ridiculous, particularly because of our experience in real life fire situations.

There is absolutely no need to cause panic among the passengers. No one has said that the detection devices need to be audible or

flashing lights to occur. Simply to be able to inform the crew, and more importantly the pilots, of that aircraft, that such a situation exists, could add to the valuable time that has been mentioned here earlier that is the difference between saving a life or not.

Mr. GLICKMAN. What would that mean?

Mr. SCHAITBERGER. Smoke- and fire-detection devices in the lavatories, cabin areas, any other concealed areas within the aircraft where such a fire could occur. Or possibly in the space inbetween the outer shell and the inner walls of the aircraft.

Mr. GLICKMAN. These are as far as you are aware fairly inexpensive devices?

Mr. SCHAITBERGER. They are very inexpensive. The most simple types are found in drug stores and hardware stores all over the country. There are certainly far more sophisticated ones than those available at a very modest cost. We are talking about the cost of an aircraft.

Mr. GLICKMAN. Have some carriers voluntarily gone ahead and done this?

Mr. SCHAITBERGER. Yes. In my statement, had I finished, I would have called attention to Boeing, which has now placed smoke detectors in its lavatories themselves.

Mr. GLICKMAN. Is this new generation 757, 767?

Mr. SCHAITBERGER. That is correct. The extinguishing agent problem is an area where more research is needed. Again, it is not a matter of hyping. It is a very serious problem, what is the result of an effective agent that may itself create a toxic gas situation, particularly in a confined area such as an aircraft cabin or lavatory. I think they would be prepared to move forward in this area.

Also, I believe the gentleman that preceded me from NASA said that their carpet research for carpet materials has really been concluded. I think the chairman may find that a lot of this research is and has been available. We simply question why the length of time to implement regulations.

Mr. GLICKMAN. Why do you think there has been such a delay?

Mr. SCHAITBERGER. We believe that it comes down to an economical issue, and possibly a concern by the industry as to how quickly this may be required and its inital cost. I think a newscast on Friday evening following our news conference—and it was not part of our presentation—the FAA has, and I cannot quote—I shouldn't use a figure, so I won't, if I can't quote it—but the newscast essentially placed two figures on the value of a life. And the criteria that they used in making certain requirements and how much per loss of life which has been experienced that would then relate to this cost.

Mr. GLICKMAN. Thank you.

Mr. Carney?

Mr. CARNEY. Thank you, Mr. Chairman.

Mr. SCHAITBERGER. If I may, sir, Mr. Carney, on that H.H. Aerospace design, let me just call to your attention—we are talking about possibly 378 airports that crash fire rescue could be eliminated from including from your State—Dodge City, Salina, Forbes Field, and in New York, among dozens, Oneida and Westchester County.

Mr. GLICKMAN. Mr. Schaitberger, for somebody who didn't have much time to prepare, you came very well prepared.

Mr. Carney?

Mr. CARNEY. Mr. Chairman, you took the words right out of my mouth. I was wondering how well Mr. Schaitberger would do if he had a few days to prepare.

You gave an excellent presentation, sir. I certainly appreciate many of the points that you made. I think, too, you had an opportunity to listen to the different agencies give their testimony today.

Mr. SCHAITBERGER. I have been very encouraged by some of those remarks.

Mr. CARNEY. Some things that look rather simple to you and me, or at least to me, turn out to be a heck of a lot more complex. When we do something to solve one problem, we might create a problem that is far greater than the problem we have just solved. I think that makes us move somewhat more cautiously, at least with the FAA.

I would hope that you would gain some appreciation for the problems that they have to deal with. I certainly commend your organization for the work that they have been doing, bringing this to the attention of the public.

I would also like to note, as was mentioned before, that the cabin fire that occurred in the Air Canada flight is something that is almost unique in the airline industry. But fires at crash scenes are far greater in number. No one can say which type of fire is worse. We want to prevent all of these; there is no doubt about it.

The aspect of having the proper firefighting equipment available at these airports is something that is very important. The decision to go to another airport that has better equipment is often made. So if you had these facilities that were better equipped at more localities, certainly it would enhance the safety record of air transportation.

I also think to myself that if there had been a smoke detector in the lavatory of that particular aircraft, could they have landed the plane any sooner or not. I don't know, but it is a good point.

I don't know what the counterarguments are. I can appreciate not wanting to alarm the passengers. And I certainly appreciate, having been in the alarm business, that you don't have to alarm passengers. There are ways you can alert the crew upfront silently, and they can take appropriate action.

I really have no questions of you. As I said before, for someone who only had a little while to prepare, you have done an excellent job. Your presentation was superb and I appreciate it very, very much.

Mr. Chairman?

Mr. GLICKMAN. One thing is that if you would like to have a formal statement——

Mr. SCHAITBERGER. We would.

Mr. GLICKMAN [continuing]. Just submit it and it will be part of the record.

Mr. SCHAITBERGER. Thank you.

[The prepared statement of Mr. Schaitberger follows:]

STATEMENT OF

HAROLD A. SCHAITBERGER

DIRECTOR OF LEGISLATION

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS,

COMMITTEE ON SCIENCE AND TECHNOLOGY

JUNE 27, 1983

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

On behalf of the membership of the International Association of Fire Fighters (IAFF), AFL-CIO-CLC, representing 175,000 professional fire fighters throughout the United States, we would like to take this opportunity to thank the Committee for providing us with this opportunity to present our views concerning the issue of aircraft fire safety. To underline the thrust of our comments, we are most concerned why the Federal Aviation Administration (FAA) has been unwilling to take action to further enhance aircraft safety regulations in the following areas: aircraft interiors, smoke/fire detection systems, crash/rescue manpower, fire fighter protective clothing, fire fighter respitory protection, aircraft cabin extinguishing agents.

While public attention has been recently focused on the aircraft fire problem as a result of the recent Air Canada tragedy and other smaller indicents reported in the media, the problem is not a new one. Ten years ago in 1973, a Boeing 707 aircraft made an emergency landing in Paris, France after a fire in a plastic waste basket near the lavatory was discovered. Despite a successful landing, some 124 people died from inhaling toxic fumes and by-products given off by the burning materials used in the aircraft interior. This represents one of the most severe problems involved in aircraft fires -- that is, injuries and deaths due to the toxic gases and smoke that result from burning cabin interiors, including seats, interior panels, carpeting, insulation, and carry-on baggage. This is highlighted by the fact that 80 percent of all deaths during an aircraft fire result from toxic gas and smoke inhalation, and not burns.

It should be noted that the seats, alone, account for a large amount of the combustible material on an aircraft. In a 300-seat aircraft, they account for 2400 pounds of potentially combustible materials. Use of less flammible and fire-resistant seating materials would go a long way in reducing deaths attributed to toxic fumes and gases. Such materials are available

today, and have been available for some time, yet the FAA has only last week announced its intention to promulgate standards which would require the use of seat-blocking material in cabin interiors in the future.

We feel it is by no coincidence that the announcement made by FAA Administrator Lynn Helms was made shortly following the Air Canada tragedy and following a recent press conference held by our International Union, charging the FAA of failing to move effectively and delaying needed standards and improvements for too long. Although this standard may be adopted in July, FAA pointed out that retrofitting current aircraft will take up to three years to satisfy the new regulation.

In testimony before the House Science & Technology Committee on Monday, June 27, 1983, FAA Administrator Helms announced the intention to implement such a standard for seat-blocking. However, immediately following Administrator Helms' testimony, NASA officials testified that technology for other interior configurations has been concluded for new carpeting materials and configurations are available for use in today's market. However, the FAA has not indicated any intention to require standards in this area.

The Committee should realize that the materials used for aircraft interiors include ABS (acrylonitrile butadiene styrene), polycarbonate, polyethylene, polypropylene, poystyrene, polyurethane and polyvinylchloride, all of which break down to give off various toxic chemicals when burning begins. These chemicals are given off as fumes which may be odorless and colorless and can be dangerous in very minute quantities. It should be realized that these toxic fumes begin to be given off long before the materials actually catch fire and burst into flames.

The IAFF beleives that technology has been available and that sufficient research, which has been conducted as far back as the 1967 Apollo tragedy, has been conducted. Standards should be implemented immediately, requiring more fire

resistant and fire-retardent materials in interiors of aircraft.

Another area of great concern to our International Union, is that current FAA regulations do not require fire or smoke detectors in aircraft cabins, lavatories or galley areas. In light of the great speed with which aircraft fires spread, and with which heat and fumes intensify, early detection and warning of fire provide precious time, time that is absolutely crucial for preventing loss of life.

It is interesting to note that in today's society many governments require the use of smoke detectors in the building of commercial structures, and many municipalities even require contractors to provide smoke detectors in residential homes. Yet the FAA still does not require the use of smoke detectors in multi-million dollar aircraft, carrying hundreds of people at a time. Recently, Administrator Helms testified in answer to a question concerning smoke detectors, that the FAA was more interested in preventing fires and did not want to chance panicking people on board aircraft with detection devices.

This seems absurd to us, since there are so many smoke and fire detection systems which do not give off audible or visual alarms to the general public, but can alert the cabin crew or cockpit crew to a fire situation and its location long before it would be detectable by the passengers. An annunciator system would not alarm the passengers but would alert the crew, again, providing valuable time which is needed in order to prevent loss of life and injuries. The question as to whether these systems are now available has already been answered, since a few new Boeing aircraft have installed fire and smoke detectors in lavatories on their own initiative.

The FAA has been notified of the need for improved smoke and fire detection. This recommendation can be found as early as 1976 in the FAA's Air Carrier Cabin Safety Survey. Additionally, the National Transportation Safety Board has recommended improved detection to the FAA as early as 1973. In light

of all these facts, the FAA's failure to require fire and smoke detectors in cabin areas and/or galley and lavatories is incomprehensible and borders on negligence.

While the FAA begins its slow movement in issuing regulations to enhance the fire safety of aircraft interiors, it is also considering taking action that could further jeopardize the safety of aircraft passengers during an emergency situation. FAA Part 139 sets out airport certification standards for assuring safety in air transportation, including the operation and maintenance of adequate fire fighting and rescue equipment. These standards are a bare minimum falling far below requirements for fire safety established by the National Fire Protection Association (NFPA) and the International Civilian Aviation Organization (ICAO).

The FAA, considering that changes in Part 139 might be necessary, contracted with HH Aerospace Design Company to develop a suggested method of improving airport certification standards in the most cost-effective way. The HH Study, among its recommendations, made two that we take strong issue with. They are: (1) the elimination of emergency equipment requirements at Index A, AA and B airports, and (2) no provision of protection for commuter airports. These recommendations to eliminate crash/fire/rescue (C/F/R) are in complete conflict with ICAO and NFPA standards, which have been accepted by all internationally recognized experts in the field.

There are several basic problems with the HH Study recommendations, deriving from inappropriate data selection and inappropriate assumptions. Two of them are:

(1) The Study was limited exclusively to U.S. aviation activites. A worldwide point of view would have been more realistic in light of the fact that in many cases accidents outside the U.S. involve American aircraft, personnel and passengers.

(2) Of the 628 accidents studied (1966-78), 221 were estimated to involve actual or potential crash injury or death by impact or fire. Excluding mid-air crashes, 16.5 percent of the 221 accidents occurred at A,AA and B airports -- the very airports where elimination of crash/fire/rescue is being recommended. The HH Study discounted 406 of the 628 accidents as having no C/F/R benefit. It is hard to understand what criteria were used in this decision. However, after careful study, it becomes evident that the presence of an actual fire was the principal factor considered.

Contrary to its original purpose, the HH Study was focused on cost benefit alone, thus inferring that crash/fire/rescue was a burden on the airport operator. The contractor based cost analyses on manpower and equipment that is presently available at airports and not that is actually required by Part 139. The estimated cost was based on data obtained at a few selected airports which were not listed, and the data was not substantiated. It must be emphasized that the only costs required for comparison purposes, for changes in Part 139, are the costs involved in providing services that are actually required by the regulation. All extra equipment is provided as a result of local assessment of risk and at the airport manager's discretion. By using the contractor's hypothetical figures, costs have been highly inflated. It should also be noted that manpower at many A and AA airports in the southern requion are used for other purposes, and would be employed whether or not crash/fire/rescue would be required -- a fact mentioned only briefly by the Study.

Additionally, the Study bases its figures on enplaned passengers. This really has no mearning,since it does not account for protection for through-passengers -- that is, everyone at risk. For example, an aircraft boarding 10 passengers may have 60 other through-passengers already on board. Most A, AA and even B airports are intermediate stops between large and medium hubs. The average seating capacity of CV 580 aircraft is 45 to 50, seating capacity

of a B 737 is 80-plus, and for the DC 9 it is 90-plus. These aircraft frequently use the A, AA and B airports. Using the lowest movement factor of 4 flights a day at A and AA airports, and 7.6 flights at B airports, the cost of protection per passenger seat is amazingly low compared with the Study's report.

Most importantly, and finally,it is well documented that 80 percent of all accidents occur on the runway or within the overrun areas. It is essentail that the rescue vehicles be so located as to insure minimum response time to this critical area. This can only be done if a crash/fire/rescue presence is maintained at the airport. In an accident the occupants are usually trapped and many would never be able to evacuate the aircraft without immediate outside assistance. Time is the fire fighter's worst enemy. In structural fire fighting, response time is usually measured in a matter of minutes. Airport response time must be measured in a matter of seconds. When considering the statistics that 80 percent of all accidents occur on the runway or within 3000 feet of the threshhold, any consideration which would eliminate a crash/fire/rescue presence at any airport where regularly scheduled passenger service is available, would be ill-conceived and an unnecessary danger for the traveling public.

We are providing a sample list of the airports which could be affected by the Study recommendations.

Providing adequate fire crash rescue equipment and personnel is not the only need which exists in our airport system today, and which the FAA has been negligent in. Fire fighting and rescue efforts in the interior of aircraft are severely limited due to the smoke and toxic by-products of combustion produced by the burning of interior materials, which we've just discussed. Two additional problems which hamper the ability of fire rescue personnel from conducting effective rescue operations are the lack of FAA standards in providing adequate fire fighting protective clothing and self-contained breathing apparatus.

The theory behind fire fighter protective equipment is to provide a protective barrier between the fire fighter and the environmental extremes of heat, cold, steam, water and toxic substances to which we are continuously exposed. While the Occupational Safety and Health Administration (OSHA) has promulgated regulations utilized by industrial fire brigades and municipal fire departments for body, head and face, hand and foot protection, the FAA only recommends in general terms the type of protective clothing that should be worn by airport fire fighters. The detailed OSHA regulations were based on performance standards developed by the National Fire Protection Association, the National Institute for Occupational Safety and Health, and the U.S. Fire Administration.

Since aircraft crash rescue personnel protective coats, pants, gloves, and hoods are not standardized, varying degrees of protection are afforded fire fighters, depending upon which airport they service. Current FAA recommendations (FAA AC 150/5210) for protective clothing are completely inadequate and obsolete. FAA does not have any performance criteria by which to measure the effectiveness of the garments. Although FAA describes an approach garment (three layer approach), they mistakenly utilize the term proximity. They also still recommend clothing fabrics that have shown to be deficient in the fire environment.

Structural and other inferior protective garments or even proximity garments are useless for aircraft rescue since a burning airplane cannot be approached without severe risk to fire fighters unless properly designed approach garments are required. Many current protective garments are made of aluminized asbestos, which can pose a cancer risk to the fire fighters, even though safer materials are now readily available, such as aluminized kevlar.

One additional problem is that most aircraft fire fighter protective clothing is not even designed to interface properly with self-contained breathing

apparatus which, again,reduces the fire fighter's capability and ability to perform rescue operations.

I would like to have one of our staff members come forth, so that the Committee can see what type of equipment and proximity garments are available on the market. Again, the importance of this garment is, one,to protect the fire fighter, but as or more important, it will allow a fire fighting crew to advance into an aircraft fire situation and conduct rescue operations which would otherwise be impossible.

I would also like to mention that one of the most important pieces of protective equipment for the fire fighter is the self-contained breathing apparatus used for respitory protection. OSHA now has regulations requiring the use of self-contained breathing apparatus during all interior structural fire fighting operations, including suppression, rescue and overhaul. While OSHA has promulgated regulations utilized by industrial fire brigades and municipal fire departments requiring the use of positive pressure self-contained breathing apparatus, there are not FAA requirements for aircraft crash rescue personnel. FAA only recommends that breathing equipment, preferably of compressed air type, be furnished. Thus, self-contained breathing apparatus are not generally worn by aircraft fire fighters, and fire fighting and rescue efforts to the interior of the aircraft are severely limited.

Another area which the IAFF believes should be thoroughly discussed and in which more research is needed is the question of appropriate portable fire extinguishing systems for aircraft cabin use. Today, there are four common types of hand-held fire extinguishers found aboard aircraft: CO_2, dry chemical, H_2O (water), and halogenated extinguishing agents (Halon 1211, 1301, etc.).

We believe that there are problems associated with each of these extinguishing materials. For example, CO_2 is not a particularly effective agent in limited supply against Class A fires. Class A fires would be those fires in-

volving normal combustible materials, such as paper towels, clothing, cloth, etc. Certain dry chemicals are effective extinguishing agents for all classes of fire, but we believe that they may interfere with electronic circuitry, as well as visibility. This could be of particular concern to the cockpit crew in an aircraft.

Halon 1211, bromo-chloride-fluoromethane, is effective at extinguishing all callses of fire, but when heated it, in itself, decomposes into toxic chemicals like hydrogen chloride, free chlorine, hydrogen fluoride, hydrogen bromide, and free bromide. Halon 1211, when used in a confined area, has been shown to cause, to humans, central nervous system effects, including tremors, convulsions and unconsciousness; and cardio-vascular effects, including hypertension, decreased heart rate, and occassional cardiac arrythmias. It can also be lethal.

This is highlighted by a death of a fire fighter on a military installation outside of Tucson, Arizona in October of 1981. Halon 1211 was the extinguishing agent being used. Although still in litigation, it appears that the toxic by-products from the halon created from its exposure to heat, gathered under the hood of the proximity suit worn by the fire fighter. We are, therefore, quite concerned as to the situation which could be created by the use of halon extinguishing agents in confined areas, such as lavatories or gallies, by crew members or other individuals.

Additionally, we feel that flight crews for many airlines are never given the opportunity to receive sufficient on-hands training in the use of portable fire extinguishers. In many instances, flight crews are only trained to use coffee and other liquid substances on board, to extinguish fires at the incipient stage. Providing flight crews with evolutionary-type training activities, in which they would be able to utilize the equipment available to them in fire emergency situations, would go a long way in increasing their capability to further assist the traveling public in the event an emergency arises.

In closing, the IAFF strongly feels that the Federal Aviation Administration has been reviewing these areas and materials, which can reduce toxicity, flammability, and add to the ability to perform successful rescue operations since the early 1970s. Years of neglect have gone by with little action from the FAA. Their recent announcements are too little, too late. It is time for our elected representatives in Congress to demand the FAA take further action to improve aircraft fire safety.

Airports Affected

If the FAA were to consider and propose regulations to implement the HH Design Study recommendations 378 A, AA and B airports would be affected. Many now have CFR protection at the airport available.

Following is a sample list of some of those airports:

Official Airport Name	Associated City	State
Candle	Candle	Alaska
Kodiak	Kodiak	Alaska
Prudhoe Bay	Prudhoe Bay	Alaska
Cedar Rapids Municipal	Cedar Rapids	Iowa
Dubuque Municipal	Dubuque	Iowa
Sioux City Municipal	Sioux City	Iowa
Dodge City Municipal	Dodge City	Kansas
Salina Municipal	Salina	Kansas
Forbes Field	Topeka	Kansas
Joplin Municipal	Joplin	Missouri
Springfield Regional	Springfield	Missouri
Scotts Bluff County	Scotts Bluff	Nebraska
Greater Wilmington-New Castle County	Wilmington	Delaware
Mercer County	Trenton	New Jersey
Oneida County	Utica	New York
Westchester County	White Plains	New York
Allentown-Bethlehem-Easton	Allentown	Pennsylvania
Williamsport-Lycoming County	Williamsport	Pennsylvania
Danville Municipal	Danville	Virginia
Lynchburg Municipal-Preston Glenn Field	Lynchburg	Virginia
Roanoke Municipal/Woodrum	Roanoke	Virginia
Kanawha	Charleston	Virginia
Tri-State/Walker-Long Field	Huntington	West Virginia
Decatur	Decatur	Illinois
Greater Peoria	Peoria	Illinois
Capital	Springfield	Illinois
Michiana Regional	South Bend	Indiana
Bishop	Flint	Michigan
Kalamazoo Municipal	Kalamazoo	Michigan
Oakland-Pontiac	Pontiac	Michigan
Tri-City	Saginaw	Michigan
Duluth International	Duluth	Minnesota
Mansfield Lahm Municipal	Mansfield	Ohio
Aberdeen Regional	Aberdeen	So. Dakota
Rapid City Regional	Rapid City	So. Dakota
Nantucket Memorial	Nantucket	Massachusetts

Worcester Municipal	Worcester	Massachusetts
Burlington International	Burlington	Vermont
Aspen-Pitkin Co/.Sardy Field	Aspen	Colorado
Pueblo Memorial	Pueblo	Colorado
Fanning Field	Idaho Falls	Idaho
Bert Mooney	Butte	Montana
Mahlon Sweet Field	Eugene	Oregon
McNary Field	Salem	Oregon
Ogden Municipal	Ogden	Utah
Snohomish County/ Paine Field	Everett	Washington
Olympia	Olympia	Washington
Yakima Air Terminal	Yakima	Washington
Natrona County International	Casper	Wyoming
Cheyene	Cheyene	Wyoming
Tuscaloosa Municipal	Tuscaloosa	Alabama
Naples Municipal	Naples	Florida
Vero Beach Municipal	Vero Beach	Florida
Albany-Dougherty County	Albany	Georgia
Columbus Metropolitan	Columbus	Georgia
Lewis B. Wilson	Macon	Georgia
Barkley Regional	Paducah	Kentucky
Gulfport-Biloxi Regional	Gulfport	Mississippi
Fayetteville Municipal Grannis Field	Fayetteville	No. Carolina
Rocky Mount-Wilson	Rocky Mount	No. Carolina
Smith Reynolds	Winston Salem	No. Carolina
Florence City-County	Florence	So. Carolina
Tri-City	Bristol/Johnson/Kingsport	Tennessee
Lafayette Regional	Lafayette	Louisiana
Lake Charles Municipal	Lake Charles	Louisiana
Enid Woodring Municipal	Enid	Oklahoma
Stillwater Municipal	Stillwater	Oklahoma
Abilene Municipal	Abilene	Texas
Laredo International	Laredo	Texas
Tyler Pounds Field	Tyler	Texas
Pulliam	Flagstaff	Arizona
Yuma MCAS/Yuma International	Yuma	Arizona
Meadows Field	Bakersfield	California
Jack McNamara Field	Crescent City	California
Modesta City-County Harry Sham Field	Modesta	California
Santa Barbara Municipal	Santa Barbara	California
Santa Maria Public	Santa Maria	California
Elko Municipal J.C. Harris Field	Elko	Nevada

Mr. GLICKMAN. Going back, you mentioned these communities in my State which has me a little bit intrigued—Salina—not Salina——

Mr. SCHAITBERGER. Excuse me. If I would have had more time, I would have pronounced it right.

Mr. GLICKMAN. Tell me a little bit about what the proposal would do.

Mr. SCHAITBERGER. Presently, for airports to be certified there are a variety of requirements. One of the requirements for airports presently is the maintenance of crash fire rescue protection at various levels. For an airport like Dulles, National, there is a certain level of requirement which far exceeds that of small municipal airports. But the point is there is a present requirement for some form of crash fire rescue protection and equipment at each of these airports. I don't know if you are familiar with Roanoke, Va., which is close by. It is a fairly large airport. All of these airports, let me also emphasize in answering this, have regularly scheduled service, and also all, with one exception, accept jet carriers. So we are not talking about a little Piper cub local airport.

This study, if it were to be implemented by the FAA, would simply remove that requirement that the crash fire rescue equipment presence be necessary in order for that airport to maintain its certification. Basically, the report comes down to say there has not been enough loss of life at these airports to justify the cost.

We think the study is terribly flawed. The World Airways situation in Boston would not have been an incident because it did not involve fire. But it certainly in real terms involved rescue, life-threatening situation. This is where we think the report is terribly flawed, which could allow the FAA to issue regulations which would remove this.

Mr. GLICKMAN. Thank you very much for your testimony.

Mr. SCHAITBERGER. Thank you.

Mr. GLICKMAN. I would say this: We will conclude our hearing today. I think that both Mr. Carney and I agree that this has been a terribly interesting hearing.

We will move ahead with respect to one aspect of the issue; that is, the nature of flammability of seats. But we fully expect that the FAA move ahead and relate the immense amount of research they are doing to potential regulatory change in other areas, particularly antimisting fuels, seat standards, and other types of activities. But I think the hearing did serve its purpose.

Our next hearing date for the subcommittee will be on July 18. It will be on the issue of airport safety and technologies relating thereto. So the hearing stands adjourned.

[Whereupon, at 12:45 p.m., the subcommittee adjourned subject to the call of the Chair.]

APPENDIX

NTSB LETTER TO FAA ON SAFETY RECOMMENDATIONS FOLLOWING 1979 DC-10 CRASH

17 MAY 1983

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter of October 5, 1982, in reply to the National Transportation Safety Board's Safety Recommendations A-79-98 through -105. These recommendations were issued December 21, 1979, and were intended to promote Federal Aviation Administration (FAA) actions which we believe to be needed to prevent recurrence of circumstances similar to those which led to the American Airlines DC-10 accident in Chicago, Illinois, on May 25, 1979.

The FAA provided interim responses to these recommendations on two previous occasions, March 20, 1980, and June 10, 1981. The Safety Board is disappointed that some of the actions proposed by FAA in the earlier correspondence which were evaluated by the Safety Board as acceptable responses to the recommendations are no longer being considered by FAA. It is surprising to us that the FAA has reassessed the need for some actions which were recommended by both the Safety Board and the "blue-ribbon" committee convened by the National Research Council in December 1979, at the request of then Secretary of Transportation Goldschmidt. Our discussion of your response is as follows:

A-79-98

Incorporate in type certification procedures full consideration of:

(a) Factors which affect maintainability, such as accessibility for inspection, positive or redundant retention of connecting hardware and the clearances of interconnecting parts in the design of critical structural elements; and

(b) Possible failure combinations which can result from primary structural damage in areas through which essential systems are routed.

The Safety Board has reviewed the Advisory Circular (AC) 25.1309.1, "System Design Analysis," issued September 7, 1982, and we concur that the guidance material provided therein along with the contents of AC 25.571.1, "Damage-Tolerance and Fatigue Evaluation of Structure," issued September 28, 1978, should enhance the consideration of failure modes during an airplane's design and certification program. The Safety Board considers the FAA's actions as responsive and is classifying Safety Recommendation A-79-98 as "Closed--Acceptable Action."

A-79-99

Insure that the design of transport category aircraft provides positive protection against asymmetry of lift devices during critical phases of flight; or, if certification is based upon demonstrated controllability of the aircraft under condition of asymmetry, insure that asymmetric warning systems, stall warning systems, or other critical systems needed to provide the pilot with information essential to safe flight are completely redundant.

The Safety Board acknowledges that the FAA's issuance of DC-10 Airworthiness Directives (AD) 80-03-10 and 81-03-03 and the operator's compliance with the actions required by those ADs has effectively corrected a causal element of the Chicago accident. However, the Safety Board is concerned that the need for redundant components in the aircraft's auto throttle/speed control and stick shaker systems, and the safeguards incorporated into the design of the wing leading edge slat control system to prevent an uncommanded retraction of the outboard slats, were not identified before the accident.

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NTSB LETTER (Cont.)

Safety Recommendation A-79-99 was intended to require the application of a design criterion to new airplanes so that the need for such safeguards is identified during type certification. Such assurance could be positively attained by incorporating an appropriate requirement into 14 CFR 25.701. We recognize that the FAA might interpret the requirements of 14 CFR 25.1309 and the guidance material contained in AC 25.1309.1 sufficiently broadly that the intent of the recommendation could be imposed in certification without further regulatory change. However, in the absence of specificity as to FAA policy in this regard, the Safety Board is unable to evaluate the related certification requirements as they will be applied by the Transport Category Airplane Certification Directorate during the certification of new airplanes.

The Safety Board will maintain Safety Recommendation A-79-99 in an "Open--Acceptable Action" status pending further discussion with FAA.

A-79-100

Initiate and continue strict and comprehensive surveillance efforts in the following areas:

(a) Manufacturer's quality control programs to assure full compliance with approved manufacturing and process specifications; and

(b) Manufacturer's service difficulty and service information collection and dissemination systems to assure that all reported service problems are properly analyzed and disseminated to users of the equipment, and that appropriate and timely corrective actions are effected. This program should include full review and specific FAA approval of service bulletins which may affect safety of flight.

The Safety Board notes that the only action taken by FAA with regard to this recommendation was the revision to Order 8120.2 which was published April 30, 1979. This revision clarified the principal inspector's responsibility at assigned manufacturing facilities and placed emphasis on improved surveillance techniques of quality control. The Safety Board considers this action and appropriate implementation by inspectors to satisfy the intent of part (a) to the recommendation.

The Safety Board does not view FAA actions as responsive to part (b). In fact, your response of October 5, 1982, appears to be in direct conflict with the assessed need for action stated in then Administrator Bond's response of March 20, 1980. That response indicated that the FAA's "analysis of the regulatory requirements of FAR 21.3, 37.17, 121.703, 121.705, 135.413, 135.415, and 145.163 concerning service difficulty reporting reveals need for revision and a regulatory project is in process." Additionally, that response detailed a program to fulfill the intent of this recommendation. Your October 5, 1982, response implies that another analysis had determined "that additional reporting requirements would cause an economic burden without yielding a corresponding increase in safety benefits" and that FAA has withdrawn the regulatory project upon which the program discussed in the March 20, 1980, response was predicated. The Safety Board believes that current limitations in the manufacturer's service difficulty and service information collection and dissemination systems were a significant factor in the chain of events leading to the American Airlines DC-10 accident. The McDonnell-Douglas service organization was aware of the engine pylon aft bulkhead flange damage experienced by Continental Airlines approximately 5 months before the accident. Had the circumstances of the damage and the hazardous consequences been analyzed by the manufacturer and the FAA, actions could have been taken to alert all operators of DC-10 airplanes and FAA principal maintenance inspectors to review maintenance procedures and initiate appropriate inspections of engine pylon aft bulkhead flanges after engine installation.

The Safety Board believes that FAA's failure to act will continue to deny industry a significant safety benefit from effective use of in-service experience. Accordingly, the Safety Board is classifying Safety Recommendation A-79-100 as "Closed--Unacceptable Action."

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NTSB LETTER (Cont.)

A-79-101

Assure that the Maintenance Review Board fully considers the following elements when it approves an airline/Manufacturer Maintenance Program:

(a) Hazard analysis of maintenance procedures which involve removal, installation, or work in the vicinity of structurally significant components in order to identify and eliminate the risk of damage to those components;

(b) Special inspections of structurally significant components following maintenance affecting these components; and

(c) The appropriateness of permitting "on condition" maintenance and, in particular, the validity of sampling inspection as it relates to the detected flaws or damage to structurally significant elements during manufacture or maintenance.

A-79-102

Require that air carrier maintenance facilities and other designated repair stations:

(a) Make a hazard analysis evaluation of proposed maintenance procedures which deviate from those in the manufacturer's maintenance manual and which involve removal, installation, or work in the vicinity of structurally significant components; and

(b) Submit proposed procedures and analysis to the appropriate representative of the Administrator, FAA, for approval.

The Safety Board continues to believe that actions such as those proposed in these recommendations are feasible and needed. Similar recommendations were included in "Investigative Report on the Matter of Maintenance and Airworthiness Procedures Concerning DC-10 Aircraft Operated by U.S. Air Carriers," submitted to the FAA by Mr. John M. Cyrocki under a covering letter dated June 25, 1979. Mr. Cyrocki was the investigator in charge of a group appointed by the FAA to review air carrier maintenance practices in the aftermath of the American Airlines DC-10 accident.

The FAA's responses to these recommendations have stressed the views that the Maintenance Review Board (MRB) is an inappropriate place for such functions since their work is completed prior to the airplane entering into service and further, that air carriers, because of operational experience not held by manufacturers, actually know more about how to maintain their airplane than do the manufacturers. Further, the FAA notes that the responsibility for proper maintenance is levied by statute on the air carrier, not the manufacturer.

The Safety Board understands the function of the MRB and the responsibility of the operator to maintain the airplane after it has entered service. Furthermore, the Board agrees that maintenance procedures may be modified and improved by the operator as experience is gained with the airplane. The intent of the recommendations, however, is to assure that the airplanes' initial maintenance program as well as the continuing modifications to that program recieve the attention needed to assure that maintenance procedures, regardless of their derivation, are safe and do not impose a risk of damage to airplane structure or systems. The MRB's function requires that the manufacturer identify maintenance-significant and structural-significant items. The airplanes' maintenance/inspection requirements are established accordingly. The Safety Board believes that in addition to establishing periodic inspection intervals, the MRB could review those structural items which would be handled or affected when major components or structures are removed or reinstalled and that special inspection requirements should be levied to deal with such maintenance. The Board agrees that the MRB would likely not identify all such maintenance operations. It is for this reason that FAA maintenance inspectors should remain aware of maintenance requirements as they develop during service.

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NTSB LETTER (Cont.)

In the case of the DC-10, McDonnell-Douglas Service Bulletins 54-48 and 54-59 were issued and called for replacement of the engine pylon bulkhead spherical bearings which necessitated separation of the pylon from the wing. The Board believes that a review of these service bulletins should have revealed the major structural elements on the wing and pylon which could be subject to mishandling or damage and that appropriate post-installation inspections could have been identified, particularly if the aircarrier-proposed procedures had been analyzed and observed.

Following the May 25, 1979, accident, representatives of the Safety Board witnessed the DC-10 engine installation procedure in the American Airlines maintenance facility in Tulsa, Oklahoma. Admittedly, the maintenance operation was observed with retrospective knowledge of the accident. However, we believe that it would have been obvious to a knowledgeable FAA maintenance inspector that the numbered step-by-step tasks prescribed by the company procedures could not be accomplished in sequence and that the removal and installation of the aft pylon bulkhead attachment bolt was a difficult task which required precise operation of the hydraulic forklift. Such observation might have prompted a trained inspector to question whether inadvertent impact of the pylon structure and the wing structure could result in damage that would degrade the structural integrity of the attachment.

The Safety Board acknowledges the inclusion of new information in FAA Order 1800.12D, "Program Guidelines for FAA Inspectors," which emphasized that inspectors should "conduct spot inspections of maintenance operations to ensure compliance with methods, techniques and practices specified by the operator's manuals and with engineering orders concerning modifications and repairs." This addition falls short of the actions the Board envisioned. It would have been more appropriate to require that maintenance inspectors, along with the operator maintenance personnel and the manufacturer's representatives, review all "new" major maintenance procedures and initially observe the conduct of such procedures to assure that they do not impose hazards to the airplane or maintenance personnel.

The FAA apparently believes that actions envisioned by the Safety Board and recommended by the Cyrocki Maintenance Review Management Team are impractical. Since the Safety Board does not agree, Safety Recommendations A-79-101 and -102 are classified as "Closed--Unacceptable Action".

A-79-103

Revise 14 CFR 121.707 to more clearly define "major" and "minor" repair categories to insure that the reporting requirement will include any repair damage to a component identified as "structurally significant."

The investigation of the American Airlines DC-10 accident disclosed that the Continental Airlines' repairs to two damaged engine pylon aft bulkheads were not reported to FAA, and consequently the circumstances of the damage were not analyzed. Had Continental Airlines reported the occurrence of damage to an engine pylon aft bulkhead flange during maintenance and had FAA analyzed the circumstances and consequences of this damage, actions may have been taken to inspect airplanes upon which similar maintenance had been performed.

The questions as to whether the repairs to the pylon aft bulkhead should have been reported by Continental Airlines under the requirements of 14 CFR 121.707 revolved around the definition and interpretation of "major" and "minor" repairs. The Safety Board agrees that the definitions stated in 14 CFR 1 and 14 CFR 43, Appendix A, provide guidance. However, testimony by both air carrier and FAA personnel at the Safety Board's public hearing in August 1979 disclosed confusion and a lack of concensus regarding the categorization of the subject repair. Similar findings were summarized in the Cyrocki Maintenance Review Management Team Report.

The Safety Board evaluated the FAA's proposal as stated in the response dated March 20, 1980, as an acceptable response to this recommendation. This proposal was to issue an advisory circular which would expand upon the guidance of 14 CFR 43, Appendix A, and designate repairs to structurally significant items as "major." The withdrawal of this proposal as a result

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NTSB LETTER (Cont.)

of public comment has prompted re-evaluation by the Board. Although, we have no positive indication that FAA action will be forthcoming in the near future, we will classify Safety Recommendation A-79-103 as "Open--Unacceptable Action" pending further results of the program noted in your October 5, 1982 response.

A-79-104

Expand the scope of surveillance of air carrier maintenance by:

(a) Revising 14 CFR 121 to require that operators investigate and report to a representative of the Administrator the circumstances of any incident wherein damage is inflicted upon a component identified as "structurally significant" regardless of the phase of flight, ground operation, or maintenance in which the incident occurred; and

(b) Requiring that damage reports be evaluated by appropriate FAA personnel to determine whether the damage cause is indicative of an unsafe practice and assuring that proper actions are taken to disseminate relevant safety information to other operators and maintenance facilities.

As indicated in the discussion regarding Safety Recommendation A-79-100, the Safety Board believes that the failure to impose a reporting requirement for damage to structure or systems inflicted during maintenance seriously degrades the effective benefits of the FAA's surveillance and service difficulty analysis programs. This position was apparently shared by the MRC "blue ribbon" panel whose report contained a virtually identical recommendation. The reversal of FAA's position between March 20, 1980, and October 5, 1982, is disappointing and perplexing to the Board.

Since FAA's position appears final, Safety Recommendation A-79-104 will be classified as "Closed--Unacceptable Action."

A-79-105

Revise operational procedures and instrumentation to increase stall margin during secondary emergencies by:

(a) Evaluating the takeoff-climb airspeed schedules prescribed for an engine failure to determine whether a continued climb speed attained in excess of V_2, up to V_2 + 10 knots, is an acceptable means of increasing stall margin without significantly degrading obstacle clearance.

(b) Amending applicable regulations and approved flight manuals to prescribe optimum takeoff-climb airspeed schedules; and

(c) Evaluating and modifying as necessary the logic of flight director systems to insure that pitch commands in the takeoff and go-around modes correspond to optimum airspeed schedules as determined by (a) and (b) above.

The Safety Board has evaluated the FAA's actions in response to this recommendation as appropriate and complete. These actions should enhance safety in the event of an aircraft emergency during the take-off and initial climb phases of flight. Safety Recommendation A-79-105 is classified as "Closed--Acceptable Action."

The Safety Board appreciates the FAA's attention to these recommendations although, we remain concerned that some key problems evidenced in the American Airlines DC-10 accident regarding FAA surveillance and service difficulty analysis programs have not, in our view, been satisfactorily solved.

Respectfully yours,

ORIGINAL SIGNED BY
PATRICIA GOLDMAN

Jim Burnett
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 19, 1983

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-83-47 through -49

On June 2, 1983, an in-flight fire occurred on board Air Canada Flight 797, and following an emergency landing at the Greater Cincinnati Airport, the cabin interior of the McDonnell Douglas DC-9-32 continued to burn. Five crewmembers and 18 passengers were able to evacuate the burning cabin; the remaining 23 passengers died in the fire.

The National Transportation Safety Board's continuing investigation of the accident has disclosed that the in-flight fire began in or near the left rear lavatory. Although there was an indication of a problem before the fire was detected by cabin attendants -- the circuit breakers for the three-phase, electric flushing pump motor in the left lavatory tripped -- the Safety Board has not related at this stage of the investigation any specific airplane components or systems to the fire's ignition source. An intensive investigation is continuing to determine the ignition source and the fire propagation pattern. The Federal Aviation Administration (FAA), the Transport Canada Aviation Safety Bureau, the Douglas Aircraft Company, and Air Canada are participating in the Board's investigation.

As part of this effort, the Transport Canada Aviation Safety Bureau has conducted an inspection of lavatory flushing motors which previously had been removed from Air Canada's DC-9s and other type airplanes. An examination of 69 flushing pump motors has disclosed that there was evidence of corrosion in many of the motors and overheat on internal wiring and armature windings of 32 of the motors. Examinations of other airplane lavatories have revealed damage to wiring harnesses associated with the flush pump motor circuit. Preliminary testing by the Safety Board of a motor which had no corrosion damage has indicated that the heat emanating from a jammed or defective flushing motor is not sufficient to initiate combustion. However, both the Transport Canada Aviation Safety Bureau and the National Transportation Safety Board believe that additional testing using pump motors with corrosion damge is required to determine whether external wiring or motor overheat is a potential fire hazard. Concern regarding a possible safety hazard associated with flushing motors was heightened by an incident on July 12, 1983, when smoke was observed that was traced to a rear lavatory on an American International Airways DC-9 which was being serviced while on the ground at Charlotte, North Carolina. The airplane's electrical system was being powered by a ground electrical power source when smoke was first observed. Shortly thereafter, witnesses noted that several circuit breakers, including those for the three-phase electric flushing motor, had tripped. Additional smoke was observed, but there was no evidence of fire damage to the airplane. The flushing motor from the American International DC-9 airplane was examined, and evidence of overheat similar to that found in the motors inspected by the Aviation Safety Bureau was discovered.

As a result of these preliminary findings, the National Transportation Safety Board and the Transport Canada Aviation Safety Bureau both believe that actions must be taken by their respective aviation authorities to assure that the internal wiring and armature windings in lavatory flushing pump motors are free from corrosion and insulation damage and that the wiring harnesses and motors are not exposed to corrosion-producing contaminants.

In a related matter, on June 25, 1983, the Safety Board was notified of a fire aboard an Eastern Air Line DC-9 airplane which occurred as the airplane was landing at Tampa, Florida. The fire began in the aft lavatory waste receptacle, and the source of ignition remains under investigation. The fire was not contained within the waste receptacle, and, as a result, the lavatory was damaged before the fire was extinguished by the airport fire department. The examination of the waste receptacle on that airplane revealed that it did not meet the requirements of Airworthiness Directive (AD) 74-08-09. Consequently, on July 1, 1983, the Safety Board recommended that the FAA immediately inspect the waste receptacles of airplane lavatories for conformity to AD-74-08-09 (Safety Recommendation A-83-46). The Safety Board appreciates the FAA's prompt actions to emphasize these inspections by issuing General Notice (GENOT) No. 8320.283 as described in your letter of July 11, 1983. The waste receptacle on the American International DC-9 involved in the July 12, 1983, incident was similarly deficient, further reinforcing our view that positive action is warranted.

Moreover, there was a significant accumulation of waste material adjacent to the waste receptacle under the area of the amenities portion of the vanity found on the previously cited American International DC-9. The Safety Board is concerned that this material can be potentially combustible. Therefore, the Safety Board believes that, in addition to an inspection of the waste receptacle itself as described in Safety Recommendation A-83-46, the areas adjacent to the receptacle should be required to be inspected periodically to assure that potentially combustible material does not accumulate.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive (1) to require an immediate inspection of the lavatory flushing pump motor and the associated wiring harnesses between the timing components and the motor in the lavatories of transport category airplanes for evidence of moisture-induced corrosion or deteriorated insulation and to require that flushing pump motors or wiring harnesses which exhibit such conditions be replaced, and (2) to establish appropriate periodic intervals for repetition of these inspections. (Class I, Urgent Action) (A-83-47).
>
> Establish, in conjunction with the flush pump motor, timer, and airframe manufacturers, a procedure which airline maintenance personnel could employ to verify that the electrical circuitry of lavatory flushing pump motors has not been damaged by corrosion or other causes so as to produce excessive heat during motor operation. (Class II, Priority Action) (A-83-48).
>
> Issue a Maintenance Alert Bulletin to require Principal Maintenance Inspectors to assure that airlines have an acceptable program (1) for the frequent removal of waste from all areas of the lavatory with particular attention to those enclosed areas in and around the waste receptacles,

and (2) which gives sufficient emphasis to areas susceptible to the accumulation of fluids in the vicinity of wire harnesses and other electrical components which can cause corrosion. (Class I, Urgent Action) (A-83-49).

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS, SUMSLEY, and ENGEN, Members, concurred in these recommendations.

Jim Burnett

By: Jim Burnett
Chairman

HAL DAUB
2D DISTRICT, NEBRASKA

COUNTIES
BURT
CASS
DOUGLAS
SARPY
WASHINGTON

PUBLIC WORKS AND TRANSPORTATION COMMITTEE

SMALL BUSINESS COMMITTEE

SELECT COMMITTEE ON AGING

Congress of the United States
House of Representatives
Washington, D.C. 20515

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JOHN HERCX
DISTRICT OFFICE MANAGER

June 24, 1983

Congressman Dan Glickman
Rayburn 2321
Sub-committee on Transportaion,
Aviation and Materials
Science and Technology Committee
Washington, D.C. 20515

Dear Mr. Glickman:

I have attached testimony that I desire to be submitted for the record at your hearing on June 27, 1983 dealing with aircraft safety.

This statement concerns the possibility of using Halon 1301 in conjunction with the FIRE PORT system in order to provide the kind of protection on domestic airliners as is had on the NASA space shuttle.

I applaud your sub-committee's interest in this issue and thank you in advance for your consideration.

With warmest personal regards, I remain

Sincerely yours,

Hal

HAL DAUB
MEMBER OF CONGRESS

THIS STATIONERY PRINTED ON PAPER MADE WITH RECYCLED FIBERS

Statement of Jerry E. White
White Manufacturing, Inc.
Omaha, Nebraska 68137

Before the House Science and Technology Committee
Subcommittee on Transportation, Aviation and Materials
July 27, 1983

Good Morning.

My name is Jerry White and I am President of White Marketing, Inc. of Omaha, Nebraska. It is my intention to provide the Committee with important information relating to the use of Halon 1301 as a fire extinguishing agent.

NASA currently uses the Halon 1301 in conjunction with a device called the Fire Port for absolute fire control on the space shuttle. Halon 1301 provides the lowest toxicity, residue-free, quick knock-down of fire with no damage to delicate elctronic equipment. The Fire Port maintains sealed housing integrity to prevent foreign particle invation yet provides immediate access to the concealed area. The Fire Port is boldly marked for repid and obvious identification by all personnel.

In any assessment of aircraft cabin fire, safety attention must be given to the kind of fire extinguishers used on commercial aircraft and their suitability.

Holongenated fire extinguishing agents (Halon) were developed following World War II as a more effective, less toxic extinguishant than carbon tetrachloride, methyl bromide, and cholor bromethane. Halong 1301 was found to be among the most effective agents and has the lowest taxicity. Therefore, this was the agent selected by the U. S. Army for further development into hand portable extinguishers and by the Federal Aviation Administration for use in commercial aircraft.

Of the many Halongenated agents that have been evaluated in the past, two are receiving wide attention for commercial and industrial application; Halon 1301 and Halon 1211. Because these two agents are related chemically, there is a tendency to consider them as being interchangeable. While some overlap in applications do occur, subtle but important differences between them create individual market segments for which each agent is best suited. The important advantages of each agent can be summarized as:

1. Halon 1301 is significantly less toxic than Halon 1211. Halon 1301 is permitted by National Fire Protection Association standards for use in total flooding systems to protect normally occupied areas. Such use of Halon 1211 is not permitted. Halon 1301 has a toxicity rating of "Group 6", the best rating available for hand fire extinguishers.

2. The extinguishing effectiveness of Halon 1301 is somewhat greater than that of Halon 1211.

3. Halon 1301 is somewhat more expensive than Halon 1211.

The conclusion must now be made that "Halon 1301" is the most effective and least toxic agent available.

It is indisputable that "Halon 1301" is the most effective and least toxic extinguishant available. Halon 1301 would be a particularly effective agent for controlling fires that would occur on airplane lavatories.

To quote from a 1980 FAA Committee Report, "Lavatories are extremely vulnerable to intense fires because the door is usually closed and the tiny room has forced-air ventilation for odor prevention. With the door closed, there is little indication of fire to outside observers." The report concluded, "A means to combat an existing fire in a lavatory without opening the door should be developed."

The "means" to combat concealed fires has been developed and it combines the effectiveness of Halon 1301 as an extinguishment with the Fire Port as a means of access.

Fire Port and Halon 1301 offers access and control of "concealed area" fires. The "Fire Port" was developed as a result of "Space Age" technology and has been used as a system aboard the space shuttle Orbiter. An excerpt from the Crew Training and Procedure Documents aboard the Orbiter states: "Each extinguisher contains a nozzle which interfaces with the fireholes located on Vehicle D & C panels. This allows the crewman to combat enclosed fires. For Fire Port locations, see Figure 3.26-3." The extinguisher referred to in the documents is a Halon 1301 extinguisher. This procedure as described constitutes the "Fire Port System," a portable flooding system.

We strongly recommend that the Members of this committee be apprised of the "Fire Port System" as a means to enhance cabin fire safety. For a minimal cost, (approximately $200.00 per lavatory) and involving a minimal weight factor (approximately 8 lbs. per lavatory), the "Fire Port System" should be considered.

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acap

AVIATION CONSUMER ACTION PROJECT
PO Box 19029 WASHINGTON, DC 20036
TELEPHONE (202) 223-4498

Executive Director
Matthew H. Finucane

Advisory Board
Ralph Nader, Chairman
Richard Clarke
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Esther Peterson
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June 27, 1983

Honorable Dan Glickman
Chairman
Subcommittee on Transportation, Aviation,
and Materials
House Committee on Science and Technology
2321 Rayburn Building
Washington, D.C. 20515

Dear Congressman Glickman:

We applaud your decision to hold hearings on issues affecting the safety of air passengers.

Ten years ago ACAP filed a formal petition at the Federal Aviation Administration asking the agency to set standards governing the amount of smoke and toxic gas released by burning cabin materials. We filed the petition along with Mrs. T.G. Baldwin, the widow of a passenger, Mr. T.G. Baldwin, who died in a crash of a United Airlines 737 at Midway Airport on December 8, 1972. Mr. Baldwin received no fatal injuries as a result of the crash, but was killed almost instantly by the inhalation of smoke and poisonous fumes. (This petition is attached).

The FAA's response to our petition was that more research was needed. Ten years later, there are still no standards and the FAA is still doing research.

The FAA is still doing research even though NASA has developed smoke and gas standards that can screen for materials, such as advanced phenolic panels, that do well in both containing fires and in producing low amounts of lethal gases.[1] Incidentally, in one test a virtually fire-proof lavatory was made with these advanced panels.

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1 "Fireworthiness of Transport Aircraft Interior Systems," John A. Parker and D.A. Kourtides, NASA Ames Research Center, AGARD Lecture Series No. 123, "Aircraft Fire Safety", (June 1982).

The FAA is still doing research even though McDonnell-Douglas came up with standards for fire, smoke, and gas under a $400,000 contract with the FAA. The FAA said it was a good job, but was not the "final answer."[2]

And the FAA is still doing research even though one manufacturer, Boeing, has gone ahead and set its own standards for smoke and gas for its new 757s and 767s. These new aircraft have some advanced panels similar to those suggested by the NASA research..

We therefore urge the committee to find out when the FAA plans to finish its research, when it plans to translate that research into regulations, and when those regulations will actually result in the installment of new materials throughout the fleet. For as we have seen once again in Cincinnati, safety delayed is safety denied.

I might add there is one important thing that could be done today that would drastically improve cabin interior materials. And that is you could install fire-blocking layers over the polyurethane foam seat cushions. Time and again experiments have shown that these thin fire-blocking layers will greatly increase passenger chances of survival. We urge you to seek immediate installation of these layers rather than allowing the FAA to gradually phase in these covers over several years after a one or two year rule-making process.

The FAA's "go-slow" approach to seat covers seems related to its concern over weight and other factors of no relevance to safety. In a December 21, 1981 press release the FAA said that "Tech Center researchers have found that under certain full-scale test conditions about 50 seconds can be gained for passenger evacuation "when fire blocking layers are put over the foam seats". An extra 50 seconds is a tremendous increase in the current evacuation time and the FAA should have required the airlines to install these covers immediately.

Instead, the agency decided to pursue seat-covers that would weigh less. According to the 1981 FAA press release "Our results are encouraging. However, the difficulty is not just a matter of finding a less flammable material, but the need for the material to be . . . lightweight and cost-effective." The material which the FAA apparently thought was too heavy, and hence would require too much fuel to cart around, was a Dupont neoprene foam blocking layer called Vonar III. According to the release, this product would add two to three pounds per seat. So Vonar was apparently discarded as an immediate solution while the FAA pursued lighter seat covers called Celiox and Norfab (aluminized fabrics used in steel mills as a replacement for asbestos suits and gloves).

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2 SCIENCE, Vol 211, February 6, 1981. The article quotes an FAA official as saying "The contractor used the best fire model available but it isn't good enough. We're going to have to run tests with primates exposed to these gases.

Ironically, the FAA's estimate of the weight may have been too high. According to a NASA paper, "It has been estimated from recent preliminary tests that optimization with regard to blocking-layer thickness and position of heat-blocked seats in the aircraft could result in a weight penalty for the wide-body transport of between 68 and 136 kg. (150-300 pounds)".[3] The important point, however, is that the FAA's regulatory process should not be based on cost considerations, and if the agency comes up with a solution like fire-blocking seat layers, it ought to put that solution into effect.

If the FAA had put out a notice of proposed rulemaking in 1981 requiring the fire-blocking layers, I'm sure the airlines would have come up with lightweight layers before the end of the rulemaking period. Instead, the FAA is coming up with the lightweight seat covers for the airlines, and rulemaking has yet to begin.

We hope that your committee can help ensure that rulemaking in this area begins and is concluded promptly and that these fire-blocking layers are installed immediately throughout the fleet.

Sincerely,

Matthew H. Finucane
Executive Director

---

[3] Parker and Kourtides, supra n. 1.

BEFORE THE

FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C.

AUG 23 10 44 AM '73

In the Matter of)
) Docket No. 9611
Smoke Emission; Advance Notice)

MOTION OF AVIATION CONSUMER ACTION PROJECT AND MRS. T.G. BALDWIN FOR EMERGENCY ACTION

The Office of Flight Standards, Federal Aviation Administration, has issued this Advance Notice of Proposed Rulemaking for the purpose of considering a rule "to establish standards governing the smoke-emission characteristics of aircraft interior materials."

Aviation Consumer Action Project is a non-profit organization established by Ralph Nader and others to promote consumer interests in the field of aviation, particularly the consumer's right to maximum air safety. Mrs. T.G. Baldwin is the widow of a passenger, Mr. T.G. Baldwin, who died in the crash of a United Airlines 737 at Midway Airport on December 8, 1972. Mr. Baldwin received no fatal injuries as a result of the crash, but was killed almost instantly by the inhalation of smoke and poisonous fumes.

The advance notice states:

> The FAA now believes that the state-of-the-art may have developed to the point that smoke-emission standards can be established.

Over four years have passed since this agency published that conclusion and this Advance Notice. Since that time significant advancements have been made in measuring and

carbon monoxide poisoning when the aircraft burned. (CAB report on the crash of a United Airlines DC-8 accident at Denver, Colorado, July 11, 1961) The Denver crash is one of three which occurred in the first half of the 1960's in which medical investigators found that carbon monoxide was present in the victims in amounts sufficient to have caused toxic incapacitation during the brief period available for emergency evacuation. The others occurred in Rome, Italy in 1964 (45 fatalities) and Salt Lake City, 1965 (43 fatalities). (See "Carbon Monoxide and Cyanide Hazards in Air Transport Accidents Accompanied by Fire," Office of Aviation Medicine, FAA, January 29, 1973.)

The Office of Aviation Medicine also cites four other accidents in which cyanide was often present in the blood studies of victims in amounts which would be incapacitating and frequently fatal. These conditions existed in accidents which involved a Capitol International Airways DC-8 at Anchorage, Alaska on November 27, 1970; an Allegheny Convair 580 at New Haven, Connecticut on June 7, 1971; a United Airlines 737 at Midway on December 3, 1972 and a North Central DC-9 at O'Hare on December 20, 1972.

Tests conducted by the FAA and others have proven that fires in aircraft cabin interiors can produce a lethal level of toxic gases in less than 90 seconds. After a crash, however, gases need not reach a fatal level to actually result in death. Passengers who are incapacitated by such gases, as they can be in less than a minute, will be exposed to the high probability of death by fire or explosion if they are not evacuated.

Death by inhalation cannot be the sole measure of the danger posed by smoke-emitting materials. The dense smoke that often blackens the cabin interior after a crash drastically impedes evacuation and thereby causes many needless deaths and injuries. The 1971 crash of a Convair 580 at New Haven dramatically proved the hazard smoke emission can pose during post-crash evacuation. None of the passengers in that accident died from the impact, but the cabin was dark and it was smoky in the rear. Fifteen of the 27 nonsurviving passengers were near the rear service door, which the passengers could not open because the instructions were obscured by the smoke. The passengers who went to the rear could not see that others were trapped there. A series of explosions finally killed the remaining passengers.

A series of accidents which occurred before the FAA began its consideration of the need for smoke emission standards should be ample proof that a standard is needed. Within the past nine months, however, three additional accidents have occurred, two at Chicago and one in Paris, France, which prove not only the need for such standards, but that the absence of standards constitutes an emergency situation which should be acted upon immediately. Seven persons on board the United flight which crashed at Midway, and at least three on board the North Central flight which crashed on the runway at O'Hare were killed because of the inhalation of smoke and toxic gases.

Two factors have been cited as the cause for the failure to evacuate in the Midway crash in which Mr. Baldwin was killed: the emergency cabin lights did not operate and the cabin rapidly filled with dense black smoke which derogated visibility and respiration. Those who were on the scene at Midway report that the smoke which caused the fatalities was largely attributable to the materials in the cabin interior.

A recent tragic accident in Paris, France should end all doubt that the smoke emission characteristics of cabin interiors can pose a serious hazard completely independent of fuel fire problems. In that accident, 124 persons died in a Boeing 707 from an in-flight fire which was fueled entirely by cabin interior materials. Foreign investigators have not completed their toxicity studies, but all indications are that smoke and toxic gases were the cause of many of the fatalities.

The Airline Industry Will Not Act to Reduce Smoke Emissions Without Strong FAA Standards.

Comments submitted by most industry representatives in this docket -- with the exception of those companies trying to market the safe materials -- indicate that improvement in this area will not come about voluntarily. Indeed, many major industry commentators rejected the need for any improvement:

> If the fuel of the aircraft is ignited at the time of the impact and the fire involves the cabin interior, the likelihood that your regulations . . . will result in a safer environment is so remote as to make your whole proposal a fantastically expensive and futile regulatory exercise.

(Supplemental Comments by the Rohm and Haas Company, December 29, 1969)

The Society of the Plastics Industry, Inc., stated flatly that "the extent of the need for smoke emission performance standards to promote increased safety in aircraft has not, as yet, been determined." (Comments, February 18, 1970) In light of this attitude, it is not surprising that the Society is the first-named defendant in a complaint filed by the Federal Trade Commission against manufacturers of several plastic products for false and misleading representations as to the fire hazard posed by their products. Many of the products cited in the FTC complaint are commonly used in aircraft interiors. (Complaint File No. 732 3040, May 30, 1973)

Many of the commentators to the docket have observed that the state-of-the-art has not been sufficiently developed to insure a fully fire/smoke resistant interior. It should be clear, however, that the technology can be expected to continue to lag behind safety needs so long as the FAA continues to fail to establish proper standards. Though the price of those materials which are currently available may be high, it can also be expected that it will stay high until the industry has some incentive to install improved materials in their aircraft.

Improved materials, however, are in fact available which could significantly reduce the production of smoke and toxic gases. Plastics exist which yield "only a tiny fraction" of the cyanide under similar fire conditions as do those in widespread use at present. They also produce less carbon monoxide. ("Carbon Monoxide and Cyanide Hazards in Air Transport Accidents Accompanied by Fire," Office of Aviation Medicine, FAA, January 29, 1973) Vast differences also exist between the toxic gas

and smoke-emission characteristics of many of the materials in common use in aircraft interiors today.

By Delaying This Rulemaking Project the FAA Has Missed An Opportunity To Set Standards Before The Industry Began A Widespread Program Of Installing Substantial Interior Modfications In Many Older Aircraft.

The U.S. airline industry is in the midst of a massive program to convert traditional narrow-bodied aircraft, such as the Boeing 707, 727 and DC-8 and 9, to what is called the "widebodied look." Millions of dollars are being spent on this largely cosmetic effort. The price of Boeing's kit varies from $160,000 for the 727 to $210,000 for the 707. By August of last year, 307 of these units had been ordered. Other companies offer similar kits and most of the major carriers have begun refurbishing their planes. (See Air Transport World, August, 1972)

The FAA has already lost the opportunity to improve the level of safety in many of these refurbished aircraft (in other areas of cabin safety besides smoke-emission), but if it acts immediately some conversions can provide an opportunity to begin installing safer cabin interiors. If the carriers continue to assert that new materials are too costly, the FAA need only point to their willingness to spend millions in quest of the fashionable widebodied look, and ask whether it is unfair to ask that a fraction of that cost be spent to save lives.

CONCLUSION

The Administrator should declare that the lack of smoke emission and toxicity standards for aircraft cabin interiors constitutes an emergency which requires immediate corrective action. Smoke emission and toxicity standards should be issued for cabin interiors which should be applied to all newly certificated aircraft, and which should be applied to all existing transport category aircraft as soon as possible.

The recent aviation disasters in Boston, where 88 persons died on a Delta Air Lines flight, St. Louis, where 32 persons died on an Ozark flight, and Papeete, Tahiti, where 79 persons died on a Pan American flight, did not involve smoke and toxic gases from cabin interior materials, but these accidents nevertheless dramatize the need to maintain the highest possible standard of safety in all areas of the aviation system. These accidents, in the context of those discussed above, demonstrate that the aviation safety system is a chain, only as strong as its weakest link. This nation has not committed billions of dollars to establish an air traffic control system, an extensive network of landing aids and a comprehensive system of safety regulations to protect human lives only to have people die after a crash because a seat cushion catches on fire.

Respectfully submitted,

Neil G. McBride
For Petitioners Mrs. T.G. Baldwin
and Aviation Consumer Action
Project
PO Box 19029
Washington, D.C. 20036

August 8, 1973

Aerospace Industries Association of America, Inc.

Office of the President

JUL 5 1983

July 1, 1983

The Honorable Dan Glickman
Chairman
Subcommittee on Transportation, Aviation and Materials
Committee on Science and Technology
U. S. House of Representatives
2321 Rayburn House Office Building
Washington, D. C. 20515

Dear Mr. Chairman:

On behalf of the Aerospace Industries Association of America, Inc. (AIA), I am enclosing three (3) copies of our statement, with attachments, concerning the FAA's Service Difficulty Reporting System and related aircraft maintenance matters.

I trust that our paper will be made a part of the Subcommittee's official hearing record.

Yours very truly,

Karl G. Harr, Jr.

Enclosures (3)
cc: Members of the Subcommittee on Transportation, Aviation and Materials

1725 DeSales Street, N.W. Washington, D.C. 20036 • (202)429-4600

STATEMENT OF
AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
CONCERNING
THE FAA SERVICE DIFFICULTY REPORTING SYSTEM AND AIRCRAFT MAINTENANCE
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

JULY 1, 1983

The Aerospace Industries Asscciation of America, Inc. (AIA), the trade association representing the nation's major manufacturers of commercial and military aircraft, spacecraft, aircraft engines and related components and equipment, appreciates this opportunity to provide our comments on the FAA's Service Difficulty Reporting System and related aircraft maintenance matters.

The diversity of aviation products results in a number of different requirements and internal procedures for handling and processing operational data relative to service difficulties and maintenance information. However, all member companies that are involved with commercial aviation products maintain reporting procedures responsive to the Federal Aviation Regulations which are applicable to their products. In addition, the larger companies, such as engine and airframe manufacturers, maintain extensive data collection and analysis capability through customer service organizations and by utilizing a number of government and private data sources such as

the NTSB, FAA Service Difficulty Reports, Flight Safety Foundation publications, ICAO reports and several others. In some cases, in addition to written hard copy data, magnetic tapes are obtained directly for use in quick access computer systems within a company.

Although internal technical procedures vary with different companies, there is general agreement and consistency among companies regarding the gathering, internal use, and reporting of operational data relative to incidents and significant maintenance events.

From the manufacturer's point of view, information feedback from in-service operation is essential at all product levels. These are the data that provide the knowledge of the real world environments in which the product must function. Most of the product and safety improvements that have evolved over several generations of commercial transport and general aviation aircraft are due in large part to the extensive recovery and analysis of operational data. To the best of our knowledge, no other transportation industry has an equal or better capability. This is due largely to the past and present systems mandated by the Federal Aviation Regulations and maintained by the FAA, and to the cooperation and support of the many domestic and foreign customer operators of these aircraft.

Nevertheless, as with all endeavors, there are some problem areas where improvements could be effected. In our view, the FAA Aviation Safety Analysis System (ASAS) currently under development will provide significant improvements. Some specific improvements that could be made in the Service Difficulty Reporting System include:

1. Obtaining more complete reporting of the required item. The FAA currently receives approximately 23,000 SDRs (Service Difficulty Reports) each year. Because of this volume, individual reports are often quite brief and cryptic by the time they are provided to the industry on magnetic tape or in written summary form. This limits the manufacturer's ability to make a high confidence judgment on the seriousness of the event for followup analysis. From the manufacturer's viewpoint, increasing depth rather than breadth would make the system more useful and cost-effective.
2. Providing for uniformity in type of events reported. There is presently some inconsistency among operators as to the type of events most frequently reported. Some report mostly structural items, others primarily system anomalies, etc. We believe that rational guidelines can be developed without impacting existing regulations or creating an increased reporting burden on the operators.
3. Avoiding overreporting of minor items following a newsworthy event. For a period of time after a newsworthy incident, the SDR system tends to overreact with respect to minor items that have only a tenuous connection to the cause of the incident. This reaction overburdens the system temporarily and can cause more significant items to be overlooked or unreported.
4. Considering a requirement to report certain maintenance errors and improper usage. These data would be useful to manufacturers for assessing the quality of their recommended maintenance procedures, operating manuals, etc.

As a consequence of these problems--and to some extent, as a consequence of the NTSB and FAA data systems' inherent time lag between noting an event and providing the manufacturer with the relevant information--the primary source for rapid and comprehensive information on significant events is presently the manufacturer's customer service reporting system. This consists of TWX's, telephone conversations and service reports.

From a safety standpoint, the critical events are almost always reported through the airframe or engine manufacturer's customer service reporting system before the SDR or other external sources of information are available. We believe that the Aviation Safety Analysis System when fully implemented, will significantly reduce this time lag, and with properly trained, qualified personnel can ameliorate the problems discussed above.

A Customer Service Technical Representative is assigned to key airports and is provided office space adequate to accommodate a complete technical library, communications network, (telephone, telegraph, facsimile copier) and adequate storage files for routine correspondence. The Field Service Representative is required to provide frequent operations reports on the operator's fleet. In addition, he immediately reports unusual operating problems and/or maintenance findings as they become known. Technical inquiries from the operator are also submitted for response within a specified time frame. The Field Service Representative also provides a periodic activity report that includes the operating time and cycles of each aircraft or engine to enable tabulations and compilation of actual aircraft operating hours and handlings.

Once received by the manufacturer, operational data is organized, filed, and distributed to appropriate personnel for review and analysis. Some companies track trends and frequencies on a periodic basis so that potential problem areas can be identified for corrective action. SDR's, for example, are most useful in the area of monitoring structural problems and higher level system and airplane anomalies which would not appear in other data systems.

Regardless of the source, these data are analyzed, usually by a specialty department in the company, and significant findings are provided to design, quality, and operational functions within the company for application to future products and procedures and consideration for changes to current items through service bulletins, manual revisions, etc.

Depending on their product and the type of authorizations granted to them by the FAA, manufacturers are also required to report specified problems and events to the FAA if they do not have knowledge that an operator has already provided such information. In addition, the larger manufacturers maintain extensive communications systems directly with their customer operators worldwide. Again, the specifics and names vary among companies, but there is consistency in policy. Generally, for the most serious events, there is a hierarchy of communication media ranging from less that 24 hours by TWX or telephone conversation to both the FAA and operators, to annual or longer periodic meetings with operators to discuss and exchange views on maintenance and operational problems and procedures. Between these extremes are any number of other communication methods. The operator is placed on automatic distribution for applicable

product letters, service bulletins, TWX's, maintenance plans, support equipment information, service related study items, operational occurrence reports, maintenance oriented magazines and many others.

For operators purchasing new products, the communications systems are set in motion well ahead of actual first delivery. Face-to-face meetings establish mutual requirements and methods. Training requirements are identified and normally include classroom activity as well as distribution of training material. Technical publications, including Maintenance Manuals, Structural Repair Manuals, Non-Destructive Test Manuals, Component Repair Manuals, Illustrated Parts Catalogs and numerous Supplier Manuals, to mention a few, are distributed with a requirement for scheduled revision service. Provisioning conferences are conducted to identify spare parts requirements, and an initial provisioning list is prepared--subject to continuous revision--based on operator feedback from actual service experience. Maintenance Planning and Support Equipment Conferences are also held to develop a maintenance plan and equipment requirements, including facilities, with each again subject to continuous revision based on operator feedback from actual service experience.

If any criticism is warranted in the area of communication between a major manufacturer and the FAA or its customers, it is not in regard to the amount and number of things reported. Rather, it is the very extensiveness of the system that can, and has, allowed significant items to go initially unrecognized as such and thereby not receive the prominence in the reporting medium that they deserve.

This potential is present in all the reporting systems previously described, as many different people must handle large quantities of reported items, and make judgments as to the significance of the event, often with little detailed information.

On balance, we believe that the industry's ongoing efforts in this area have contributed significantly to the maintenance of a safe and efficient air transportation system. History has proven the communications to be prolific and beneficial. We strive to improve the types, the methods and the candidness of these communication links to the mutual benefit of the operators, the manufacturers and the flying public. We believe further improvements should be oriented toward achieving more consistency and depth of reported information, rather than expanding the breadth and quantity of required reporting. We believe this will improve the ability to recognize potentially serious events, and reduce the masking effect of the many non-significant and cryptic reports which are of limited value and which over-burden the reporting systems.

In view of the Subcommittee's decision to expand the scope of its June 27 hearing to include an overview of fire safety standards for aircraft cabin materials, we are attaching to this statement an Appendix outlining the industry's fire safety position, together with a copy of our recently released study entitled "Fire Resistant Seat Cushions."

APPENDIX

AEROSPACE INDUSTRIES ASSOCIATION FIRE SAFETY POSITION

Because the aircraft industry is dedicated to the highest fire safety standards, commercial passenger aircraft are designed to industry standards which exceed Federal Aviation Regulations (FAR). Since 1967, our standards have changed cabin construction materials drastically. For example, high smoking plastics and low-burn resistance wood veneer for cabin linings were replaced by self-extinguishing, low-smoking materials prior to an upgrade in Federal regulations. In addition, epoxy-impregnated, glass reinforced fabrics have been replaced by phenolics, on the basis of smoke emissions and burn resistance. These factors overruled the superior manufacturing qualities of the epoxies. Smoke and toxicity have been significantly reduced by the reduction of organic materials and the substitution of sheet metal and glass fabrics. Continual aircraft weight savings programs have also reduced the quantity of organics within the cabin. In addition to cabin materials, inflatable evacuation slides were made available with thermal protective aluminized coatings in order to extend their time of usefulness in a post-crash fire situation.

Since 1967, FAA fire safety regulations have been upgraded from a horizontal maximum burn rate of four inches per minute to a requirement that materials self-extinguish in fifteen seconds when tested vertically. In addition to FAR burn test regulations, the industry tests

all candidate materials for smoke emission, and uses the least smoking materials. To further scrutinize materials, laboratory and large scale tests are conducted to determine heat release rates, thermal decomposition temperatures, toxic gas emissions, oxygen index values and fire containment capabilities.

The complexity of an aircraft cabin requires a multitude of materials with a diverse range of properties. Some materials are inherently more fire resistant than others, leading aircraft designers to continually search for new and improved materials, with fire safety characteristics such as greater resistance to ignition and burn, lower smoke emission values, reduction of noxious fume generation and avoidance of high heat release values.

It should be understood that the terms "self-extinguishing" and "fire-proof" are NOT interchangeable. The cabin materials of aircraft certified since 1967 are "self-extinguishing" in accordance with the requirements of FAR 25.853. This means a material may burn when exposed to a bunsen burner flame, but will self-extinguish as required when the flame is removed. Cabin materials currently in use are the best materials available for meeting the functional requirements of the aircraft. These functional requirements could be severely compromised if arbitrary fire safety standards were indiscriminately applied.

An industry-wide assessment of aircraft fire safety was undertaken by the FAA's Special Aviation Fire Explosion Reduction (SAFER) Advisory Committee. The Committee's findings, published in 1980, highlighted the following:

- Near-term improvements in cabin fire safety can only be accomplished by new designs employing currently available materials.
- The concept with the greatest potential for reducing post-crash fire risk is anti-misting kerosene (AMK).
- Toxicity test standards do not exist for aircraft fire situations. Further, there is no agreement among specialists on the approximate magnitude (statistical) of the toxic contribution from burning interior materials relative to the contribution from burning turbine fuel or other fire-related hazards.
- There is incomplete data on the hazards of human exposure to toxic gas mixtures likely to be emitted from aircraft cabin materials or fuel during a fire.
- Irritants (gases and smoke) may have a real but unquantified effect on slowing egress from an aircraft.
- Reduction of the potential toxic threat from thermal decomposition products, through controlled selection of interior materials based on relative performance in small-scale toxicity tests with experimental animals, cannot be recommended at this time.
- For the purpose of material selection, assessment of relative toxicity, solely from results of chemical analysis for selected components of thermal decomposition products, cannot be recommended at this time.

In an effort to reduce toxic gas emissions, aircraft designers have been reducing the quantity of organic materials within the cabin and

avoiding organic materials which produce excessive amounts of noxious fumes. This is the only approach available to the designer until toxicology research provides a clear understanding of the problem.

The most promising near-term fire safety improvement to the aircraft cabin is the improvement in the fire resistance of passenger seats. An exhaustive research program was conducted by government and industry to find new production seating materials. New fire resistant materials could not be found, but a concept to protect the cushion materials with a fire resistant envelope was developed. Full-scale testing has indicated that this concept will significantly reduce the thermal threat of seating materials, and it has been endorsed by the Aerospace Industries Association (AIA) in the report entitled "Fire Resistant Seat Cushions", attached hereto.

When considering passenger fire safety, statistics show that the most severe threat to survivability is the thermal threat from a post-crash fuel fire. Anti-misting kerosene (AMK) is the most promising solution to this problem and should be pursued vigorously with adequate research funds.

After the SAPER committee completed its work, the AIA Transport Airworthiness Requirements Committee (TARC) formed a project group to address in-flight and post-crash fire threats. Specifically, this project group is charged with (1) establishing fire scenarios to be addressed, (2) determining ignition sources, combustibles and propagation methods to be considered, (3) recommending to the FAA and NASA large-scale tests that will be required to establish needed data. The AIA-TARC group will continue to work with NASA, the FAA and the Air

Transport Association (ATA) to evaluate possible solutions to the most severe threat level scenarios defined. The committee will present its position during 1983.

The aircraft industry uses a small portion of the non-metallic materials produced for the industrial world. Because of this, the material suppliers are not motivated to expend their own resources to develop material characteristics to satisfy our unique needs. The current aircraft research programs directed at developing better materials must be pursued, and we trust that both NASA and the FAA will continue to aggressively support these efforts. It is our hope that continuing research will show as much progress in the next 20 years as we have been able to achieve in the last 20 years.

FIRE RESISTANT SEAT CUSHIONS

Aerospace Industries Association (AIA) of America, Inc.

Transport Airworthiness Requirements Committee
Project 210-9 Final Report
June 14, 1983

TAPC 83-66

SUMMARY

Several events and programs in 1977 through 1980 emphasized the likelihood of significant contribution by the urethane seat cushions to airplane cabin fires. In 1979 the SAFER (Special Aviation Fire and Explosion Reduction) Advisory Committee to the FAA formulated the short term recommendation to develop fire blocking layers for urethane cushions and the long term recommendation to develop low smoking, fire resistant aircraft seat cushion foam. The recommendations were formalized in 1980 with the final SAFER report. The AIA-TARC Project 210-9, Fire Resistant Seat Cushions, was established to provide cohesive support by airplane manufacturers to the FAA to define guidelines for seat cushion constructions with improved fire performance.

The AIA effort has been part of a closely coordinated program with the FAA and NASA including testing, data analysis and cost benefit evaluation. The analysis of laboratory fire test data and full scale fire test results on candidate seat cushion configurations has led the 210-9 project to technical conclusions and recommendations for improving and evaluating the fire resistance of airplane seat cushions.

Although specific, quantitative test values could not be established for seat cushion fire resistance, an available seat cushion fire blocking layer has been defined as exhibiting a desirable level of fire performance, and test methods have been identified for screening and validating candidates for comparative performance.

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1.0 INTRODUCTION

Presented herein are the results, conclusions and recommendations from an AIA TARC Project Study on fire resistant airplane seat cushions.

2.0 BACKGROUND

In 1980 the AIA-TARC Project 210-9 Fire Resistant Seat Cushions" was established to define guidelines for airplane seat cushion construction that would provide improved fire performance. Primary events leading to the project initiation were:

- 1977 - A NASA contract was initiated with the McDonnell Douglas Corporation to evaluate new materials and configurations to improve fire properties of aircraft seat cushions as part of the FIREMEN (Fire Resistant Materials Engineering) program.

- 1979 - A destructive fire occurred in a Bay Area Rapid Transit (BART) car involving seat cushions with urethane foam. Dr. Brady Williamson (University of California - Berkley) was contracted to study the fire. McDonnell Douglas was contracted by BART to test in full scale fires three seat cushion configurations utilizing different foams and coverings.

- 1979 - NASA-JSC conducted full scale tests on airplane interior fire performance using jet fuel fires. The Boeing Company conducted similar tests simulating flame exposure with heating lamps and propane flames. The NASA contract with McDonnell Douglas continued, encompassing laboratory tests and both fuel-fed and simulated fire full scale tests of seat cushion configurations.

- 1979 - SAFER (Special Aviation Fire and Explosion Reduction) Advisory Committee (to the FAA) formulated recommendations that in the short term fire blocking layers should be developed for urethane cushions and in the long term low smoking, fire resistant aircraft seat cushion foams should be developed. The AIA participated in development of the recommendations based on data from the preceding events.

3.0 OBJECTIVE

When Project 210-9 was first established, it was proposed that properties for acceptable seat functional performance would be identified to support guidelines for improved fire performance based on available materials meeting the functional properties objectives. In March 1982, it was agreed within the project that meeting these objectives was not practicable using seat design experience readily available within the AIA and could not be accomplished within a reasonable time. Experience and discussions with the airline and seating industries had shown that many of the passenger seating functional properties are based subjectively upon "comfort". In addition, seat functional properties are not determined solely upon seat cushion materials, but are highly dependent upon seat and seat cushion design.

The project objective was then revised to define a desirable level of fire resistance consistent with materials available giving reasonable consideration to durability, cost, weight, apparent comfort, etc. Airlines and seat manufacturers must collaborate on passenger seat and seat cushion design to meet specific functional needs while providing the recommended level of fire resistance. The AIA members are involved in flight crew and attendant seat design considerations for improved fire resistance and functional requirements; but, the small number of such seats makes cost and weight less significant than for the passenger seats.

4.0 APPROACH

For the purpose of this project, the seat cushion is defined as the fabric, cushion reinforcement (slip cover), fire blocking layer (where used) and the foam. The approach established to gain the objective stated in section 3.0 was:

- o Gather data/conclusions/recommendations from existing seat cushion tests, development programs, and involved industry representatives.
- o Evaluate the results of programs to establish fire resistance guidelines for functional seat cushions.
- o Draft guidelines for fire resistant seat cushions identifying those areas in which lack of data, available materials or fabrication technology prevents or limits industry capability to develop guidelines.
- o Apprise government and industry of needed R&D.
- o Participate with R&D where appropriate.

4.1 Seat Cushion Test and Development Program Review

In 1980 there were many programs in progress or proposed which related to this project. Those reviewed and evaluated were:

a. NASA-ARC/McDonnell Douglas Corporation Fire Resistant Seat Program

b. NASA-JSC/McDonnell Douglas Corporation Cabin Fire Simulator (CFS) Seat Cushion Burn Tests

c. FAA/NASA-ARC/McDonnell Douglas Corporation C-133 Post Crash Cushion Burn Tests

d. FAA/DuPont C-133 Cushion Burn Tests with Vonar and FS-200 Fire Blocking

e. NASA-JSC 737 Tests of Improved Fire Resistant Interior Components, e.g., linings and seats

f. NASA/Southwest Research Institute Room Size Calorimeter Tests

g. AMI Lightweight Passenger Seat Employing an Advanced Composites Seat Structure

h. BART/McDonnell Douglas Corporation Evaluation of Seat Cushions

i. NASA-JSC/Solar (International Harvester)/Weber Aircraft Evaluation of Polyimide Seat Cushions

j. Pan American Airlines/DuPont In-Service Evaluation of Vonar Fire Blocking

k. American Airlines/Solar In-Service Evaluation of Polyimide Seat Cushions

l. FAA/NASA-ARC/McDonnell-Douglas Corporation Short Term Fire blocking Optimization Program (Proposed in 1980)

m. FAA/NASA Interagency C-133 Fire Tests of Baseline and Improved Cabin Interiors

4.2 Government and Industry Cooperation

After reviewing the programs, the TARC project reached several conclusions. An AIA letter relating these results was sent to the FAA in early August 1981. This letter and the formal FAA replies are in Appendix A. In January 1981, the TARC project had met with the FAA and NASA at the Technical Center and had attended a NASA-sponsored review of fire resistant seat cushion programs at Houston in February 1981. By August 1981, the results of the AIA program review had been discussed with the FAA Technical Center personnel. The FAA arranged a meeting of NASA, FAA and AIA representatives to formulate plans in research and development on the fire resistant seat cushion concept. The letters in Appendix 10.1 attest to the beneficial results of the cooperative planning conducted by those involved.

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4.3 Government and Industry R&D Response

Briefly, the reviews and discussions ended with the following major conclusions for action.

- The high density of neoprene (i.e. LS-200) is unacceptable for complete airplane cushions and the functional properties of polyimide foam are unproven; therefore, fire blocking is still the only currently viable solution for improved seat cushion fire resistance. NASA-ARC under an interagency agreement with the FAA would optimize for cost and weight possible state-of-the-art fire blocking configurations utilizing laboratory scale fire test methods. This would demonstrate concept feasibility and practicality.

- The FAA Technical Center C-133 fire test facility is the best available instrument to evaluate the actual fire performance characteristics; however, baseline and proposed configurations need evaluation at conditions other than just the large post-crash scenerio currently being tested. The FAA would continue to use the near-maximum post-crash scenerio but would also test under ramp (pre-flight, post-flight) and in-flight conditions as well. The FAA/NASA Interagency Agreement would also provide for McDonnell Douglas to test full scale configurations with fire exposure simulated by radiant heat from quartz lamps and ignition with a propane torch.

- Laboratory and/or small scale tests are needed for configuration screening, certification, and quality control purposes. Eleven seat cushion configurations were established for evaluation by fire tests. NASA-ARC would provide uniform material samples for specimen construction, and NASA, FAA, Lockheed, McDonnell Douglas and Boeing would participate in laboratory/small scale tests. Results would be compared to large scale test data obtained at the FAA Technical Center and McDonnell Douglas.

5.0 FULL SCALE FIRE TEST RESULTS

Not all full scale tests planned by the FAA have been completed. Also, not all those conducted have been documented formally. However, the FAA has informally reported Technical Center test results to this TARC project and the tests conducted by McDonnell Douglas have been documented. Sufficient data is available to establish desirable fire resistance for state-of-the-art fire blocking materials.

5.1 FAA C-133 Fire Tests

A surplus C-133 airplane has been modified by the FAA Technical Center to accomodate full scale fire testing of airplane interior components. The testing can be conducted under simulated conditions for wide-body commercial jet transport operations. The test facility and results of seat cushion fire blocking tests are described in more detail in Reference 1.

In each test the blocking layer material is installed as an interliner between the upholstery cover and foam cushion. Table 1 is a list of candidate blocking layer materials evaluated. Table 2 describes the ignition sources for each type fire tested. The significant findings were summarized in Reference 1:

> "Based on the realistic cabin fire tests and analysis described in this paper, and on the seat cushion blocking layer materials evaluated and the types of fire test conditions employed, the following are the significant findings:
>
> (1) Seat cushion fire blocking layer materials such as neoprene foam or aluminized high-temperature fabrics can prevent ramp and in-flight fires which become out of control when initiated at an unprotected seat and left unattended.
>
> (2) Seat cushion fire blocking layer materials can significantly increase the safe time available for evacuation during specific types of postcrash cabin fire scenarios.

TABLE 1

MATERIALS EVALUATED IN C-133 FULL SCALE TESTS

MATERIAL	CHEMICAL COMPOSITION
Baseline	
(1) Wool (90%)/Nylon (10%) Fabric	-
(2) FR Urethane Foam	-
Foam Blocking Layer	
(3) Vonar®, 3/16 in. thick, 24 oz/yd^2	FR polychloroprene
(4) LS-200, 3/8 in. thick, 34 oz/yd^2	FR polychloroprene
Fabric Blocking Layer	
(5) Norfab®, 13 oz/yd^2	Blend of predominantly aromatic polyamide fibers wrapped around a fiberglass fire core, aluminized outer surface
(6) Preox®, 11 oz/yd^2	Heat stabilized polyacrylonitrile, aluminized outer surface

(1) Type of seat upholstery cover used in all tests
(2) Fire-retardant
(3) Registered Trademark, DuPont Co., Wilmington, Delaware
(4) Product of Toyad Corporation, Latrobe, Pa
(5) Registered Trademark, Norfab Corporation, Morristown, Pa
(6) Registered Trademark, Gentex Corporation, Carbondale, Pa

TABLE 2

IGNITION SOURCES FOR FAA C-133 FIRE TESTS

TYPE OF FIRE	IGNITION SOURCE
Ramp	o Plastic trash bag filled with approximately 18 ounces of paper towels and newspaper
In-Flight	o Cigarette o Newsprint (4 double sheets) o Gasoline (1 pint) o Simulated nylon flight bag (contents 2 shirts and 2 double sheets of newsprint approximately 22 ounces)
Postcrash	o Jet fuel (80-square-foot pan containing 50 gallons of fuel)

(3) Under severe fire conditions, such as a postcrash fuel fire, neoprene foam materials are more effective seat cushion blocking layers than aluminized high-temperature fabrics.

(4) Fire-retardant urethane foam can be replaced by nonfire-retardant urethane foam in aircraft seat cushions covered with a blocking layer material without essentially any loss in in-flight fire protection."

A review of reference 1 reveals that except for the severe post-crash fire conditions, the aluminized fabric fire blocking performed as well, or nearly as well, as the much heavier foam blocking layers. The results implied that in many post-crash fire conditions the aluminized fabric would be nearly as effective as the foam blocking. Only in the very severe post-crash fire condition was the foam fire resistance appreciably better than that of the aluminized fabric. However, the protection afforded the cushion by the aluminized fabrics delayed development of hypothetically unsurvivable cabin thermal conditions by 70% as long as did use of a foam blocking layer.

5.2 FAA/NASA/McDonnell Douglas Corporation Fire Tests

Under a FAA/NASA Interagency Agreement, NASA-ARC contracted the Douglas Aircraft Company of McDonnell Douglas Corporation to conduct simulated fire tests of thirteen seat cushion configurations. The tests were conducted in the Douglas Cabin Fire Simulator (CFS) using a quartz lamp radiant energy panel and a propane pilot flame. Reference 2 describes the test facility and the results. The test article consisted of two full-size simulated seat cushions (two bottoms and two backs) situated side by side on a frame suspended from a weighing apparatus. The radiant heat source was arranged as a flat vertical panel parallel to, and six inches from, the outside edges of one seat bottom and back (Figure 1). The radiant incident flux measured in a plane parallel to, and six inches from, the panel was approximately 10 watts per square centimeter. This is representative of the heating rates which might be experienced by seats near an open door or a large fuselage rupture in a large post-crash fire situation.

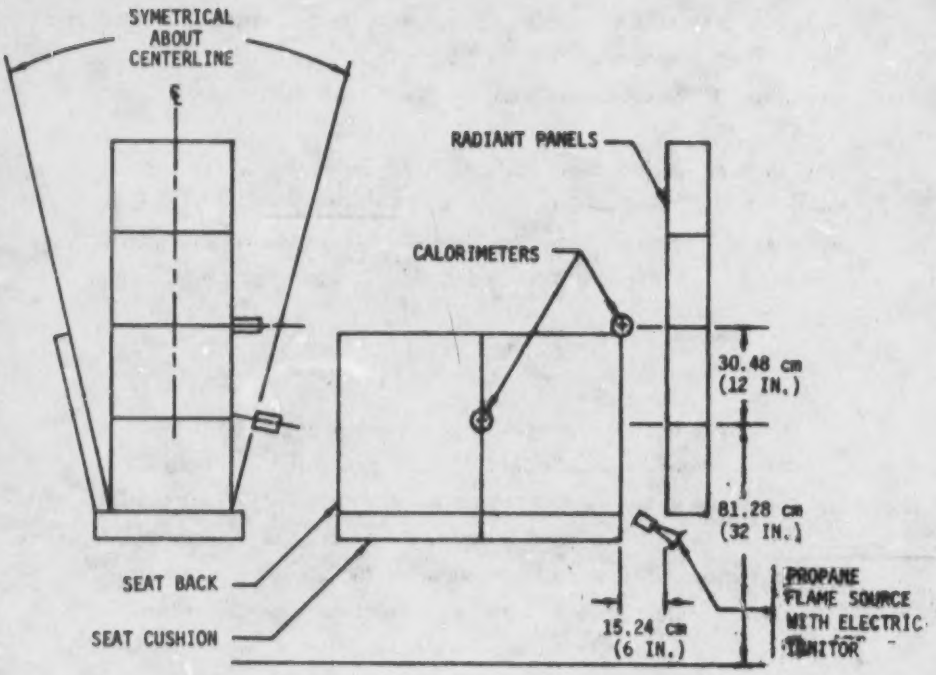

FIGURE 1 SET UP FOR McDONNELL DOUGLAS FULL SCALE FIRE TESTS

Thirteen seat cushion configurations were tested with five minutes of radiant heat exposure. After fifteen minutes each test was considered complete. Post-test photos were taken and seat residue was weighed.

The thirteen seat cushion configurations are listed in Table 3 and their materials are described in Table 4. Both tables are reproduced from Reference 2. Results of weight loss analysis are shown in Figure 2 from Reference 2. Reference 2 concluded and recommended the following:

CONCLUSIONS

"Urethane foam decomposes into a volatile gas when exposed to a severe heat source. If this generated gas can be contained in such a manner as to prevent its igniting or to control the rate at which it burns, the severity of the fire will be reduced. This was clearly shown in the testing of standard cushion constructions with a protective covering, "fire-blocking", enveloping the urethane foam.

When the fire blocking was able to contain the decomposing urethane by-products, i.e., fluid and gas, the cushions closest to the heat source burned with less intensity, generated a minimum of heat and were unable to ignite the adjacent cushions. However, when the decomposing urethane fluid was able to escape from the fire-blocking envelope and pool on the floor, an uncontrolled fire erupted which resulted in total burning of all cushion materials.

Some of the Norfab and Celiox materials utilized aluminum coatings. It was not the aluminum's reflecting properties which made the cushions perform well as it was its non-permeable properties. This coating helped contain the decomposed by-products and prevented propagation to the adjacent cushion.

TABLE 3

SEAT CONSTRUCTIONS EVALUATED IN McDONNELL DOUGLAS FULL SCALE FIRE TESTS

CONSTRUCTION NUMBER	DECORATIVE UPHOLSTERY	SLIP COVER	FIRE BLOCKING	FOAM
1	Wool-Nylon	None	None	F. R. Urethane *
2	Wool-Nylon	Cotton-Muslin	Vonar-3	F. R. Urethane
3	Wool-Nylon	Cotton-Muslin	Vonar-2	F. R. Urethane
4	Wool-Nylon	None	3/8 LS 200	F. R. Urethane
5	Wool-Nylon	None	Celiox 101	F. R. Urethane
6	Wool-Nylon	None	Norfab 11 HT-26-AL	F. R. Urethane
7	Wool-Nylon	Cotton-Muslin	Vonar-3	N. F. Urethane *
8	Wool-Nylon	None	Norfab 11 HT-26-AL	N. F. Urethane
9	Wool-Nylon	None	None	LS 200 Neoprene
10	Wool-Nylon	None	None	Polyimide
11	Polyester	None	None	Polyimide
12	Wool-Nylon	None	Norfab 11 HT-26	F. R. Urethane
13	Wool-Nylon	None	PBI	F. R. Urethane

* F. R. Urethane (Fire Retarded Urethane)

* N. F. Urethane (Non-Fire Retarded Urethane)

TABLE 4
MATERIALS IN THE McDONNEL DOUGLAS FULL SCALE FIRE TESTS

MATERIAL	SOURCE
#2043 urethane foam, fire-retardant (FR), 0.032 g/cm^3 (2.0 lb/ft^3) 43 ILD	North Carolina Foam Ind. Mount Airy, NC
Urethane foam, non-fire retardant (NF), 0.022 g/cm^3 (1.4 lb/ft^3) 24-35 ILD	CPR Division of Upjohn Torrance, Ca.
Vonar-3, 3/16-inch thick with Osnaburg cotton scrim (23.5 oz/yd^2) .079 g/cm^2	Chris Craft [illegible] Trenton, NJ
Norfab 11HT26-aluminized (12.9 oz/yd^2) .044 g/cm^2, aluminized one side only	Amatex Corporation Norristown, Pa.
Gentex preox (celiox) (10.9 oz/yd^2) .037 g/cm^2, aluminized one side only	Gentex Corporation Carbondale, Pa.
Wool nylon (0.0972 lb/ft^2) .0474 g/cm^2 90% wool/100% nylon, R76423 sun eclipse, azure blue 78-3080 (ST7427-115, color 73/3252)	Collins and Aikman Albermarle, NC
Vonar 2, 2/16 inch thick, .068 g/cm^2 (19.9 oz/yd^2) Osnaburg cotton scrim	Chris Craft Industries Trenton, NJ
LS-200 foam, 3/8" thick (33.7 oz/yd^2) .115 g/cm^2 LS-200 foam, 3-4 inches thick (7.5 lb/ft^3) 0.12 g/cm^3	Toyad Corporation Latrobe, Pa.
Polyimide Foam (1.05 lb/ft^3) .017 g/cm^3	Solar Division, International Harvester San Diego, Ca.
100% polyester (10.8 oz/yd^2) .037 g/cm^2 4073/26	Langenthal Corporation Bellevue, Wa.
Norfab 11HT26 Approximately (11.3 oz/yd^2) .038 g/cm^2	Gentex Corporation Carbondale, Pa.
PBI Woven Cloth Approximately (10.8 oz/yd^2) .037 g/cm^2	Celanese Plastic Company Charlotte, NC

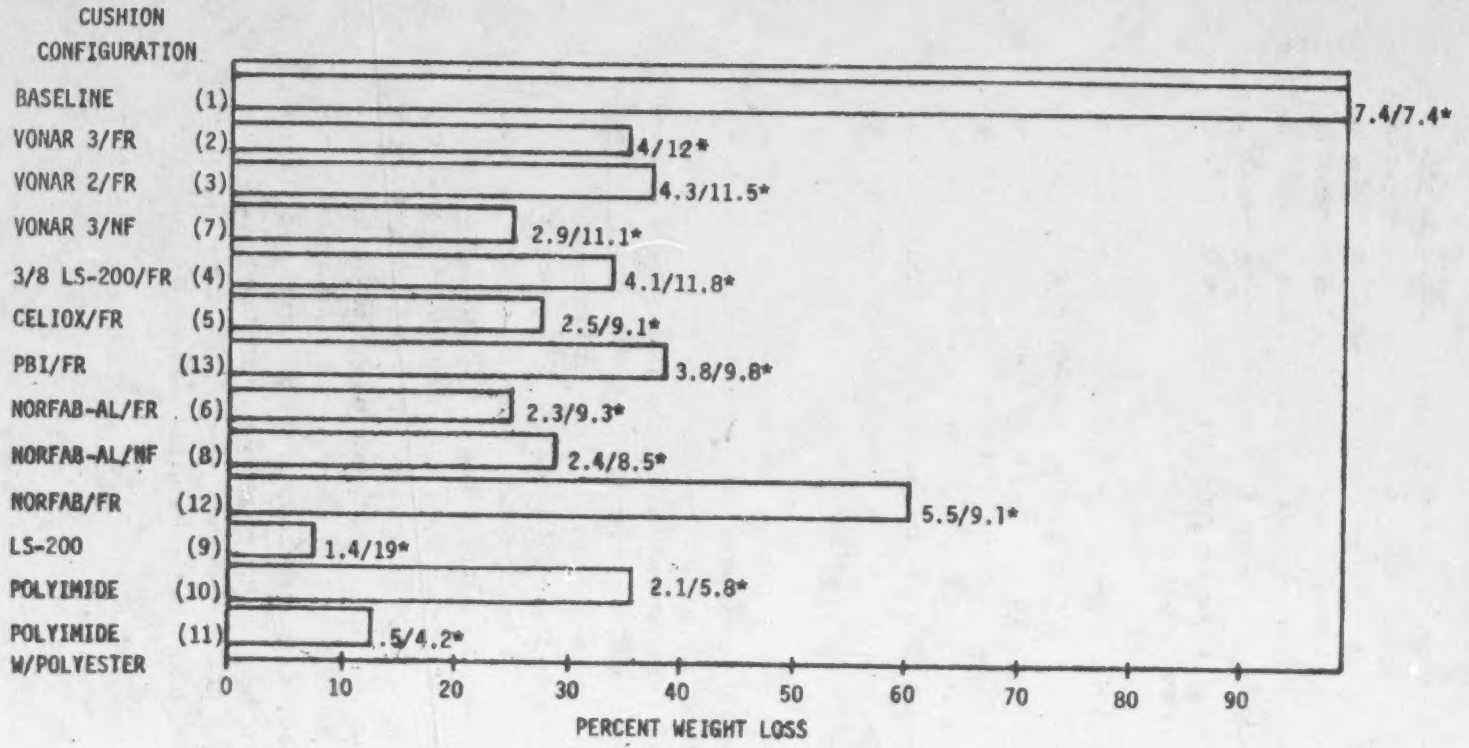

FIGURE 2 WEIGHT LOSS IN McDONNELL DOUGLAS FULL SCALE FIRE TESTS

Had the seams held and all the gases vented out the back of the cushions and away from the heat, the decomposing of the cushions may have been even less severe. Undoubtedly, the reflective properties had an effect in slowing down the decomposing of the urethane, but only by a few seconds. The reason being the emissivity and thermal conductivity of the aluminum coating was inadequate to resist the severe radiant energy being applied to the surfaces.

The charred foam fire-blocking layers did not act primarily as a heat barrier as they did a liquid and gas barrier. In the cushions farthest from the radiant source, the urethane foam still thermally decomposed. It formed a pocket of gas behind the intact charred envelope. This was verified in post test inspection. However, the gas escaped slowly and only created a small pilot flame. The flame extinguished itself when the radiant energy source was switched off.

The polyimide cushions are examples of a foam which thermally decomposes at high temperatures and generates gas and char but no noticeable liquids. The wool-nylon upholstery trapped gases between itself and the foam. When these gases ignited, the foam decomposed rapidly. The polyester upholstery decomposed from the cushions fast enough to prevent the trapping of these gases. Subsequently, the foam in the cushions decomposed at a slower rate. From these tests, it is concluded that no matter the foam used as a core for the cushion, if the gases generated by the foam can be expelled or contained in such a manner as to prevent their burning or reduce the rate at which they burn, a severe fire can be avoided or delayed. It is further concluded that if the thermal decomposition characteristics can be altered so as to slow down the generation of gas, the time before a fire becomes severe can be extended to the point where appropriate extinguishment of the fire may be possible."

RECOMMENDATIONS

"It is recommended that a study be made to incorporate cushion designs and fire-blocking materials which are thermally stable and nonpermeable to urethane fluids and gases to prevent or reduce the rate at which a seat cushion burns.

This study should include considerations for wearabiiity of fire blocking layers, fatigue life of cushion foams and methods of venting decomposition gases from the cushion assembly. Test results from this program have shown that seam constructions significantly affect cushion burn performance. Therefore, seam constructions previously studied by the NASA seat program should be reconsidered in future cushion designs.

It is also recommended to use these studies as a basis to develop a design standard for a fire resistant passenger seat. This standard must be supported by inexpensive laboratory burn test methods that can verify these standards are being met."

As was stated in the conclusions, Figure 2 shows that all the fire blocking layers reduced the percent of total material burned. It is also apparent that the aluminized fabrics (configurations 5, 6 and 8) were more effective than the non-aluminized fabrics (configuration 12). The performance of the aluminized fabrics in these tests is consistent with that found in the tests with real fires (Reference 1) discussed in Section 5.1.

6.0 LABORATORY FIRE TEST RESULTS

August 25-26, 1981, FAA, NASA, and AIA technical representatives met at the FAA Technical Center to coordinate development of small scale fire test criteria for seat cushions with improved fire resistance. Data from small scale tests conducted by the participants on various seat cushion configurations were reviewed. A concensus developed that no test method was adequately defined and sufficiently available to establish a "GO-NO GO" standard for seat cushions with improved fire resistance. Therefore it would be necessary to establish a configuration standard considered to have an acceptable performance within state-of-the-art materials availability. Any proposed seat cushion systems could be compared to the standard for equivalency.

The representatives agreed that the primary fire blocking characteristics pertinent to fire performance are probably fire spread, time to foam fire involvement and heat release rate (for cushion, including blocking and foam). Smoke and toxicant release should not be a primary concern with materials presently being considered as control of these properties is beyond the state-of-the-art test methods. However, it is assumed that unusually high smoke or known high toxicant producers would not be used.

It was suggested that urethane foam wrapped in 181 E-glass fabric be considered a possible standard. Such a standard, although unusable as a practical seat cover, would be readily available for comparison tests. The samples would be consistent in quality and properties and would probably provide an acceptable degree of fire blocking for comparison purposes. It was agreed that the concept was desirable but that the selection of glass fabric would have to be validated by large and small scale tests.

Since all previous small scale testing had been accomplished at different places with different test apparatus on different seat cushion fire blocking configurations, it has been difficult to evaluate the degree of data correlation from one test to another and with large scale test results. It was decided that a fire retardant foam baseline and six fire blocking concepts on fire retardant foam should be tested in the available test facilities at participating organizations for mutual comparison, and for comparison to C-133 and CFS results. In addition, two of the fire blocking materials would be tested on a non-fire retardant foam having the same comfort and functional properties as the 2.2 pcf F.R. foam. Unprotected polyimide and LS-200 foam specimens were added to the test configuration list to make a total of eleven. It was hoped that a test for fire blocking performance could indicate the acceptability of new fire resistant cushioning materials and concepts as well. In all cases the same decorative wool upholstery would cover the specimens; however, slip covers would not be used as part of the tested configuration unless the slip cover is considered a portion of the fire blocking. The configurations selected for test are shown in Table 5, reproduced from Reference 3. The configurations will be designated by the numbers shown throughout this report section.

Some of the test methods available to participants may be operated readily at several selected heating rates (i.e., the NBS Smoke Density Chamber and the OSU). It was agreed that wherever possible, on these facilities, testing should be done at 2.5, 5.0 and 7.5 W/cm^2 to determine performance over a range of heating rates the cushions may most likely encounter in airplane fires. To insure specimen uniformity at the testing agencies, FAA and NASA-ARC ordered and distributed all materials as part of the FAA/NASA interagency agreement. The testing conducted and the results are summarized in the following sub-sections.

TABLE 5

SEAT CUSHION CONFIGURATIONS FOR FIRE TEST METHODS EVALUATION

CONFIG-URATION	FOAM	FIRE BLOCKING LAYER (FBL)	FBL kg/m^2	WEIGHT oz/yd^2	SUPPLIERS OF FIRE BLOCKING LAYERS
1	FR urethane	none			
2	FR urethane	Vonar® -3, 0.48 cm (3/16 in)*	0.91	27.07	Chris Craft Industries 1980 East State St. Trenton, NJ 08619
3	FR urethane	Vonar® -2, 0.32 cm (2/16 in)*	0.67	19.97	Chris Craft Industries 1980 East State St. Trenton, NJ 08619
4	FR urethane	LS-200 neoprene® 0.95 cm (3/8 in)	1.15	33.7	Toyad Corporation 16 Creole Drive Pittsburg, PA 15239
5	FR urethane	Preox® 1100-4 aluminized Preox® fabric, plain weave, neoprene CTD, P/N 1299013	0.39	11.53	Gentex Corporation P. O. Box 315 Carbondale, PA 18307
6	FR urethane	Norfab® 11HT-26-Al aluminized on one side, 25% Nomex® 70% Kevlar®, 5% Kynol®, weave structure 1x1 plain	0.40	11.8	Amatex Corporation 1032 Stonabirdge St. Norristown, PA 19404
7	FR urethane	181 E-Glass			Uniglass Industries Statesville, NC
8	NF urethane	Vonar® -3, 0.48 cm (3/16 in)	0.92	27.07	Chris Craft Industries 1980 East State St. Trenton, NJ 08619
9	NF urethane	Norfab® 11HT-26-Al	0.40	11.8	Amatex Corporation 1032 Stonabirdge St. Norristown, PA 19404
10	LS-200 Neoprene®	none			
11	Polyimide	none			

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NOTES ON TABLE 5:

All decorative upholstery is a wool/nylon blend fabric (R76423 Sun Eclipse, Azure Blue, 78-3880) by Collins & Aikman, Albemarle, NC

Suppliers of Foams:

FR urethane (No. 2043 FA foam, density of 29.9 kg/m^3 or 1.87 lb/ft^3): North Carolina Foam, P. O. Box 1112, Mt. Airy, NC 27030

NF urethane (medium firm, IL032, density of 23.2 kg/m^3 or 1.45 lb/ft^3): Foam Craft, Inc., 11110 Business Circle Dr., Cerritos, CA 90701

Polyimide foam: International Harvester, 701 Fargo Ave., Elk Grove Village, IL 60007

LS-200 neoprene foam: Toyad Corporation

* The Vonar was on a cotton fabric carrier.

6.1 NASA-ARC Small Scale Tests

The most extensive program of laboratory scale testing and analysis of the eleven cushion configurations was conducted by NASA-ARC through the FAA/NASA interagency agreement. This program also included the large scale simulated fire tests conducted by McDonnell Douglas (see 5.2) and weight/cost/durability studies. The entire program is reported in reference 3. The laboratory scale tests and results will be summarized here. Conclusions and recommendations of the program will be included in sections 7.0 Comparison of Laboratory and Full Scale Test Results and 8.0 Conclusions and Recommendations.

6.1.1 NASA-ARC T-3 Burner Tests

A series of initial screening tests for potential candidate blocking layers was conducted by Scientific Service, Inc. The objective was to compare the effects of thermal exposure on several of the seat cushion configurations by measuring the time that it took to raise the surface temperature of the foam material to 300°C (598°F) using the T-3 burner described in reference 3 Appendix A. Heat fluxes tested were 11.3W/cm^2 (9.95 Btu/ft^2 sec) and 8.5 W/cm^2 (7.49 Btu/ft^2 sec). Results in order of descending time for the foam to reach 300°C were:

CONFIGURATION NO.	FIRE BLOCKING LAYER
4	0.95 cm(3/8 in.) LS-200
2	0.48 cm(3/16 in.) Vonar 3
3	0.32 cm(2/16 in.) Vonar 2
6	Norfab 11HT-26-Al
5	Preox 1100-4
7	181 E-Glass
1	No Fire Block Layer

The thermal threat of these tests was extreme and short foam protection times were observed. Reference 3 stated:

> "The NASA T-3 burner test results were inconclusive in determining the fire protection afforded by various fire blocking layers and foams and does not appear to offer a viable small scale testing procedure for these purposes."

6.1.2 NASA-ARC Studies of Mass Injection by Thermal Degradation

This investigation was done by San Jose State University. An NBS smoke density chamber was modified to measure weight loss as well as smoke density.

The tests were conducted on 3 in. x 3 in. specimens with 1/2 inch thick cushioning foam wrapped with the appropriate fire blocking layer and the upholstery material. The sample was exposed to only radiant heating with no pilot flame. Specimen weight was measured continuously throughout the test. Complete testing procedures and setup may be found in Reference 3.

Tests were conducted at incident heat fluxes of 2.5, 5.0 and 7.5 W/cm^2. From the weight loss data at 2 minutes into the radiant heat exposure, the specific mass injection rate (m) was calculated for ten of the eleven configurations.

$$\dot{m} = \frac{\text{(weight loss)}}{\text{(area of sample exposed)}\ \ \text{(time elapsed)}} \quad \frac{g}{cm^2\ sec}$$

The results for this calculation are shown in Figures 3 and 4 developed from data in Reference 3. It can be seen that all experimental configurations demonstrated significantly lower mass injection rates than the baseline, configuration 1, when exposed to either 2.5 or 5.0 W/cm^2. The reduction in mass injection rate was not as significant for some fire blocking layers with 7.5 W/cm^2 exposure.

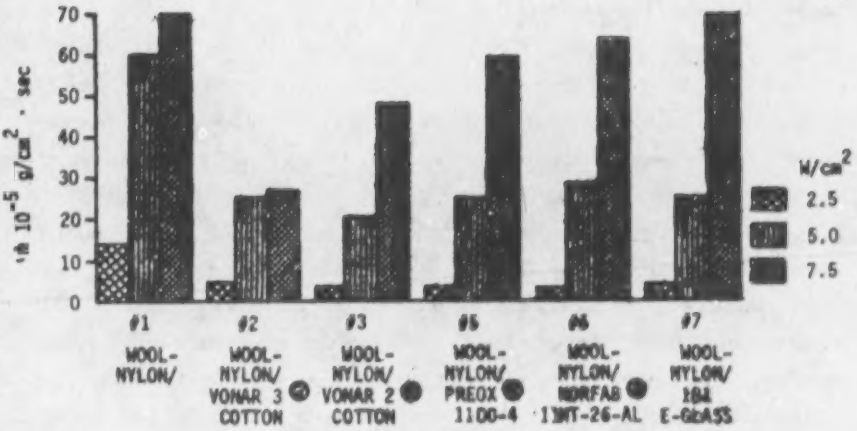
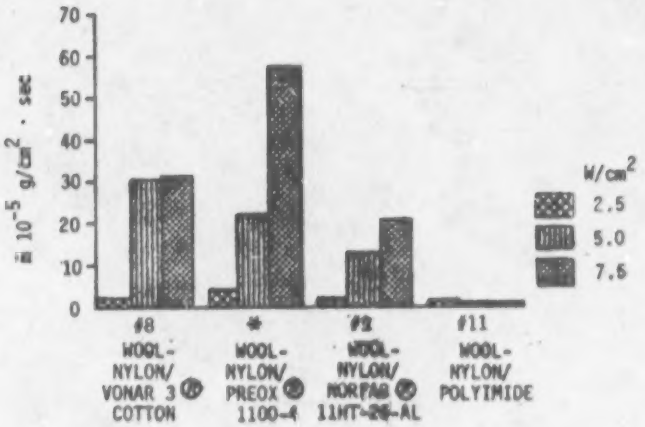


FIGURE 3: SPECIFIC MASS INJECTION RATE OF F.R. URETHANE FOAM AT 2 MIN.



* CONFIGURATION IN ADDITION TO ORIGINAL 11

FIGURE 4: SPECIFIC MASS INJECTION RATE OF N.F. URETHANE AND POLYIMIDE FOAMS AT 2 MIN.

6.2 Lockheed Meeker Burner Tests

The Lockheed Aircraft Company (Lockheed-California Company) conducted tests on the eleven configurations using the specimen holder developed for compliance with tests required in FAR 25.853 and a Meeker burner. The set-up is described in Figure 5. Adjustment of the flame to specified temperatures is defined in Figure 6. Samples fabricated as shown in Figure 7 were tested with 60 seconds exposure to the Meeker burner flame. The results of the flame test are summarized in Table 6. It is noted that all but the baseline demonstrated short after-flame times. All demonstrated much shorter foam burn lengths than observed for the baseline, with the neoprene blocking layers, the neoprene foam and the polyimide foam burning less than those foams protected by fabric fire-blocking. The burning intensity of the polyimide sample was significantly greater than all but the baseline. However, the length of polyimide foam burned was short. This phenomena will be discussed more in Sections 7 and 8.

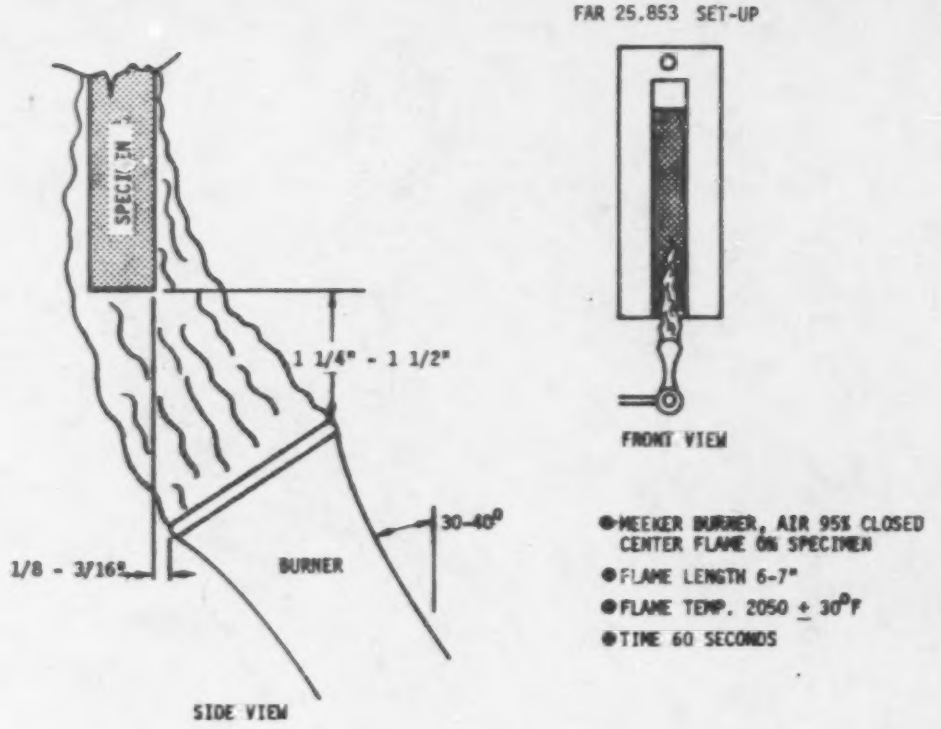


FIGURE 5: MEEKER BURNER FLAME TEST SETUP

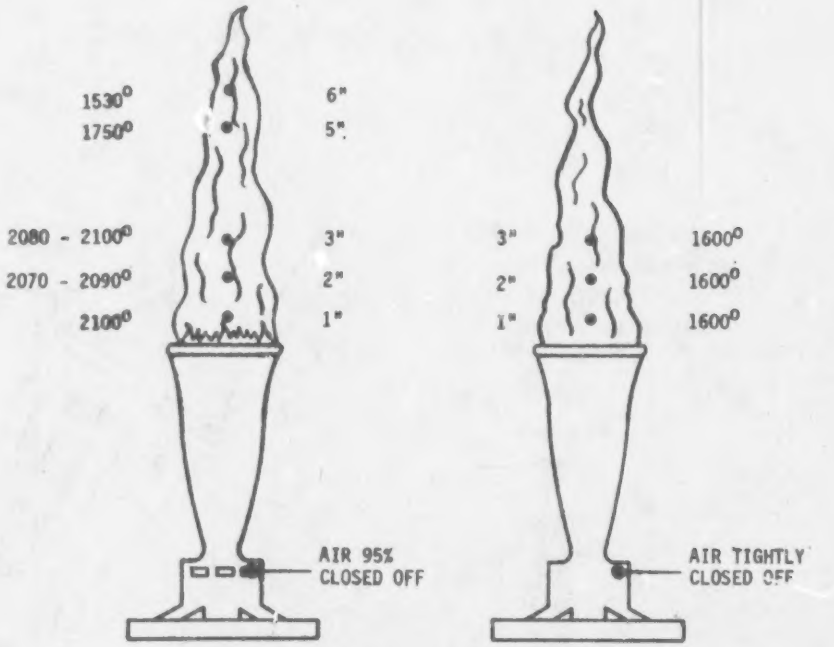
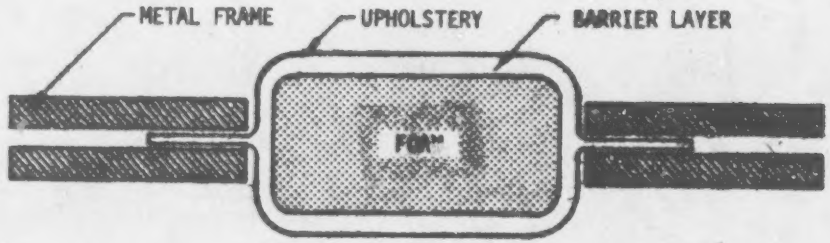


FIGURE 6: MEEKER BURNER FLAME TEMPERATURE ADJUSTMENT



CROSS SECTION VIEW

FOAM	2" W x 1" T x 12" L
BARRIER LAYER	4 1/2" W x 25" L
UPHOLSTERY	4 1/2" W x 25 1/2" L

FIGURE 7: SPECIMEN CONFIGURATION FOR MEEKER BURNER FLAME TEST

TABLE 6

MEEKER BURNER FLAME TEST RESULTS

NO.	CONFIGURATION	BURN INTENSITY	BURN LENGTH, INCHES		AFTER FLAME (SECONDS)
			UPHOLSTERY	FOAM	
1	BASE	5	9 3/4	5 3/4	60+
2	VONAR 3	2	5 1/4	1/8	0-2
3	VONAR 2	2	5 1/4	5/16	0
4	LS-200	2	4 1/2	1/8	0
5	CELIOX	3	4 3/4	1	2
6	NORFAB	2	4 3/4	1 1/4	3
7	181 E GLASS	2	4 3/4	1 1/8	3
8	VONAR 3, NF	2	4 1/4	1/4	0
9	NORFAB, NF	3	5	1 1/4	0-6
10	LS-200 FOAM	2	4 1/2	1/8	0
11	POLYIMIDE	4	7	1/2	0-2

BURN INTENSITY 1 = GOOD, 5 = POOR

6.3 OSU Tests

The Ohio State University Release Rate apparatus has been evaluated extensively at many laboratories including Boeing, the FAA and McDonnell Douglas. The basic apparatus and a proposed procedure are described in reference 4. Unfortunately, the operating procedures for airplane materials have not been established, and much of the equipment has been modified to unique testing concepts of the individual laboratories. There were significant differences in the OSU testing procedures used by Boeing, the FAA Technical Center and McDonnell Douglas. Some of the more significant differences are obvious in Table 7. Because of these differences, correlation of absolute values of heat and smoke release would not be expected. Figures 8 through 13 summarize accumulated release values for specific times as related to the release from configuration No. 1 (baseline) expressed as 100%.

It should be noted that McDonnell-Douglas did not test configuration Nos. 3, 7, 10 and 11 and tested other configurations at only 2.5 W/cm^2 and 5.0 W/cm^2. Other blank charts on the figures occur because data were not reduced for all specific times by each participant. The absolute OSU data expressed in appropriate units are in Appendix 10.2.

First examination of the OSU heat release data in Figures 8 through 10 does not reveal a great deal of consistency of ranking between testing agencies. However, it must be remembered that a means is being sought for screening materials with relative level of fire resistance rather than ranking the eleven configurations in absolute order.

If it is assumed, as the FAA preliminary large scale tests indicate, that neoprene foam blocking layers provide one level of fire resistance, fire resistant fabrics a lower level of resistance and the replacement foams another level, then the configurations can be grouped and coded to demonstrate this. The Figures 8 through 13 have been coded to group configurations 2, 3, 4, and 8 as neoprene foam blocking layers, configurations 5, 6, 7 and 9 as fabric blocking layers and configurations 10 and 11 as replacement foams.

TABLE 7

OHIO STATE UNIVERSITY (OSU) RELEASE RATE
CALORIMETER OPERATING PARAMETERS

	BOEING	DOUGLAS	FAA
SAMPLE SIZE	6" x 6" (15.2 cm x 15.2 cm)	10" x 10" (25.4 cm x 25.4 cm)	6" x 6" (15.2 cm x 15.2 cm)
RADIANT FLUX	2.5, 5.0 & 7.5 W/cm^2	2.5 & 5.0 W/cm^2	2.5, 5.0 & 7.5 W/cm^2
TYPE IGNITION	SAMPLE LOWER EDGE	SAMPLE LOWER EDGE	EVOLVED GASES
PRIMARY AIRFLOW	21 FT^3/MIN (0.01 m^3/SEC)	15 FT^3/MIN (0.0071 m^3/SEC)	21 FT^3/MIN (.01 m^3/SEC)
MIXING AIRFLOW	63 FT^3/MIN (0.03 m^3/SEC)	45 FT^3/MIN (0.021 m^3/SEC)	63 FT^3/MIN (.03 m^3/SEC)
THERMOPILE	COMPENSATED	UNCOMPENSATED	COMPENSATED

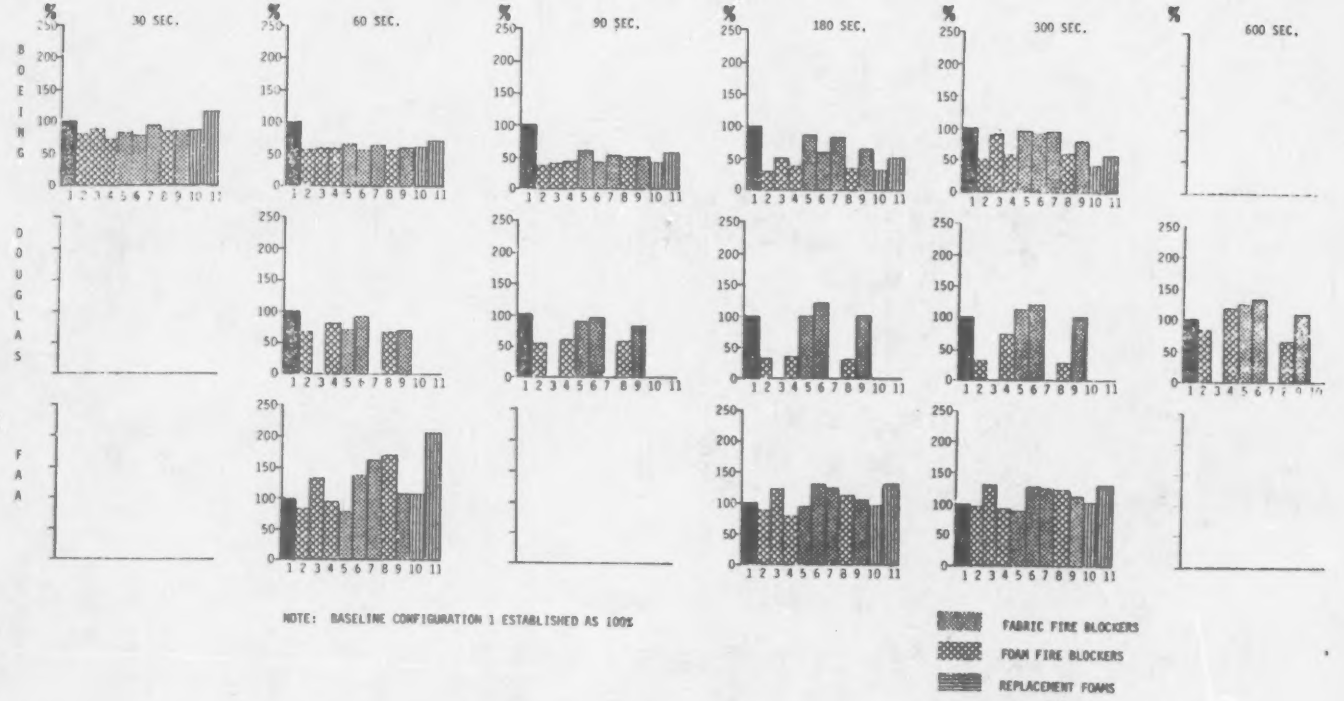


FIGURE 8 COMPARISON OF OSU HEAT RELEASE AT 2.5 W/cm^2

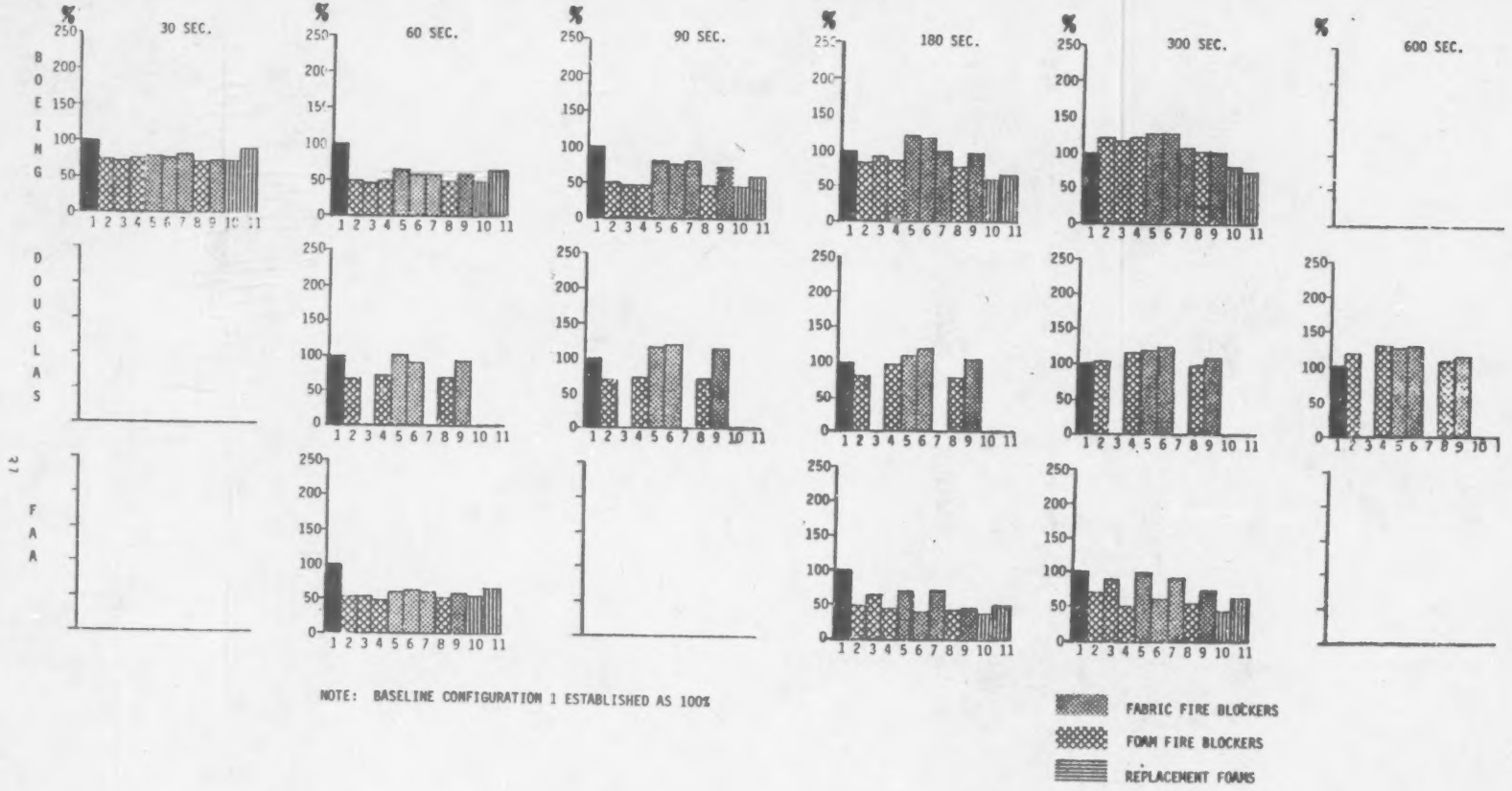


FIGURE 9 COMPARISON OF OSU HEAT RELEASE AT 5.0 W/CM^2

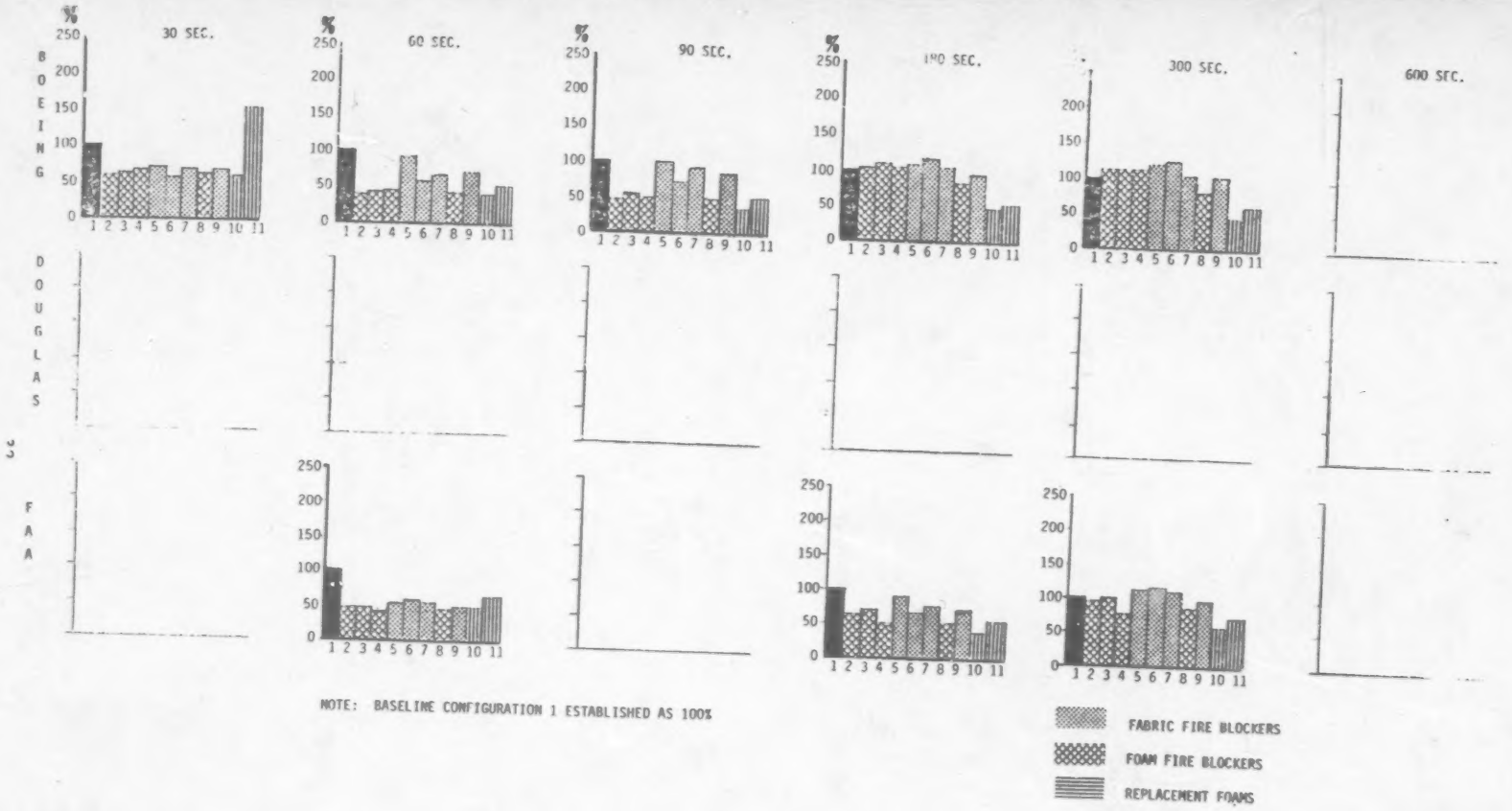


FIGURE 10 COMPARISON OF OSU HEAT RELEASE AT 7.5 W/CM^2

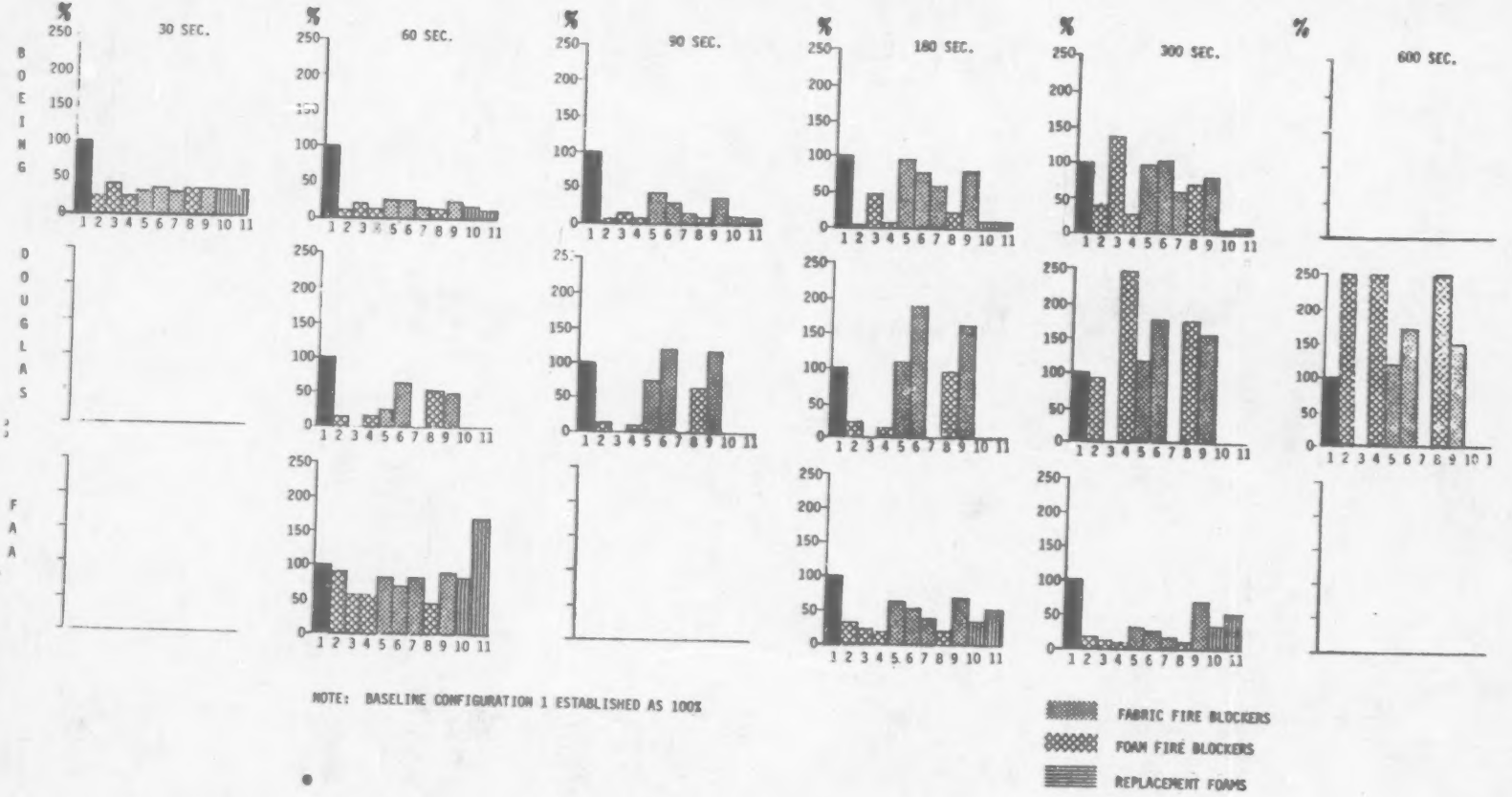


FIGURE 11 COMPARISON OF OSU SMOKE RELEASE AT 2.5 W/CM^2

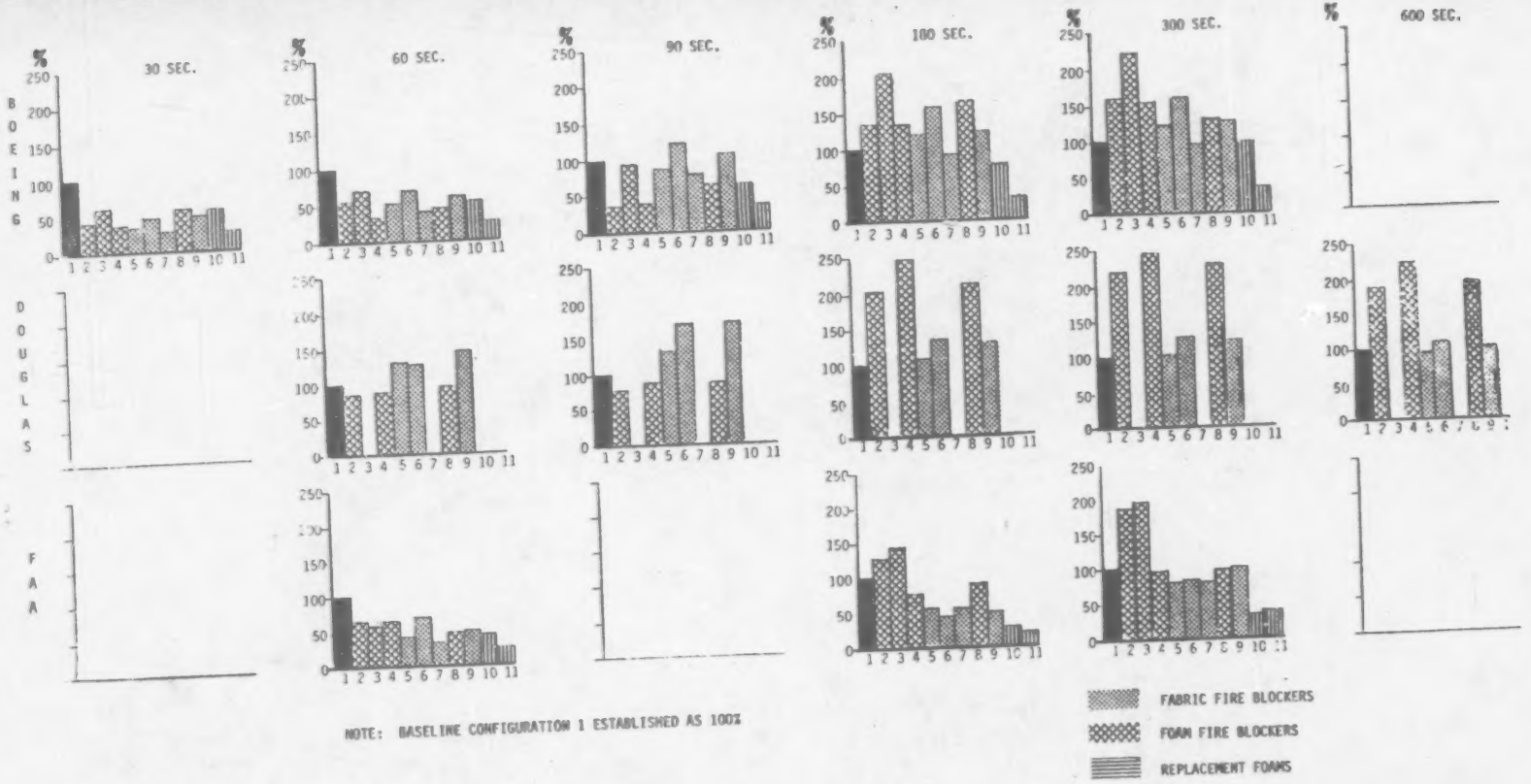


FIGURE 12 COMPARISON OF OSU SMOKE RELEASE AT 5.0 W/cm^2

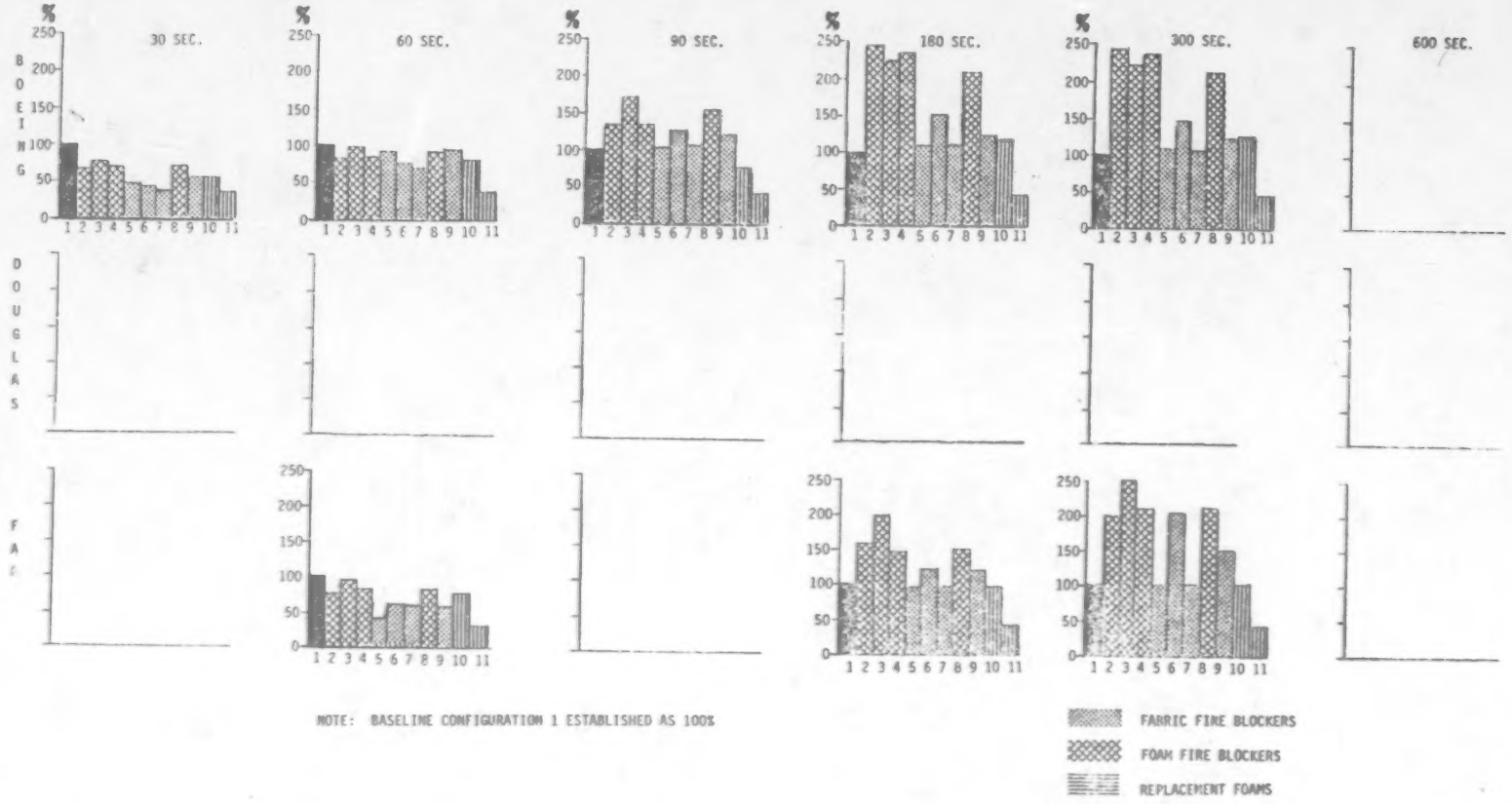


FIGURE 13. COMPARISON OF OSU SMOKE RELEASE AT 7.5 W/cm^2

7.0 COMPARISON OF LABORATORY AND FULL SCALE FIRE TEST RESULTS

From the full scale fire tests conducted in the FAA C-133 fuselage (Reference 1) it appears that the fabric fire blocking layers tested are effective in preventing the spread of probable ramp and in-flight seat cushion fires.

A minimum amount of testing with simulated post-crash fires showed a [illegible] fire blocking layer beneficial in slowing the spread of fire, but less effective than the thicker and heavier neoprene foam fire blocking layer. These results are consistent with technical reasoning. Barring the use of metallic or other non-organic materials with high melting and burning temperatures, it is to be expected that the thicker non-porous materials would provide the better initial thermal protection for the urethane foam. These same materials could be less permeable to vaporized or liquified flammable foam products than the fabrics.

The photographic data of the closely controlled simulated-fire radiant heat tests conducted by McDonnell Douglas generally confirmed the results of the FAA full-scale, high-thermal-threat, post-crash fire tests. The weight loss data requires more than casual examination because each fire blocking layer added a unique weight increment to the baseline seat weight. Use of cushion foams other than urethane also resulted in changes in the specimen weight. Percent weight loss may be indicative of the extent of fire spread; however, total heat released is a parameter which cannot be ignored. Weight loss data is related to heat release only (1) if all material lost is burned and (2) if the heat of combustion for the material is known or if it can be assumed that all applicable materials have the same heat of combustion. Neither of these two points can be readily assumed for these experiments.

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Generally, based on limited test data from each of several different fire threats, it may be said that the fabrics tested provide a significant level of fire blocking, the foam layers provide a greater level of protection and the replacement foams reduce the fire involvement to an even lower level. Examination of all the laboratory tests shows the same trend. The time to elevated foam temperatures in the T-3 burner exhibited the desired trend, although the data may have been difficult to interpret, and the method not applicable to evaluation of replacement cushion foam benefits.

The results of the mass injection rate experiments also predicted the large scale fire test results, and indicated the superiority of the foam blocking layer protection at high heating rates found in the post crash fire condition. The results at 5.0 W/cm^2 in the laboratory tests probably are most predictive of the overall protection offered by the blocking layers. Evaluation by only the specific mass injection rate assumes (as does evaluation by weight loss) that all material injected is combustible and has the same heat of combustion.

The Meeker burner tests gave the same performance trend when the amount of foam burned is examined and, in addition, confirmed some large scale test results (see 5.2 and reference 2) not predicted by other laboratory tests: viz, polyimide foam by itself is quite fire resistant, but when used with some upholstery materials will burn significantly more, resulting in increased heat release and fire spread.

The OSU heat release data gives the most quantitative data of all the laboratory tests. However, the variety of conditions employed by the round robin participants demonstrates the lack of standardization of the equipment and methods used in the aircraft field. It appears that the results of FAA and Boeing OSU tests taken at 5.0 W/cm^2

between 30 and 180 seconds test time correlates well with large scale test results. This time period and test flux also are representative of the values found important for those parameters in the full scale FAA-C133 post-crash tests. The protection given by the fire blocking layers is not so apparent in the Douglas OSU test results. However, good correlation to the FAA and Boeing data can be found if it is assumed that Douglas' recorded heat release for the baseline configuration is low. This assumption would lessen the relatively greater than expected heat release values of the fire-blocked configurations.

As an observation, much of the OSU smoke release data show the fire blocked configurations produce measurably more smoke than the baseline configuration, with the fabrics producing less than the neoprene foam layers. The increase in smoke is probably not significant when compared to the benefits from the decreased fire spread and lower heat release.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

8.1.1 Full Scale Tests

The AIA Project 210-9 bases the following conclusions on the full scale fire test results:

1) Both the fabric and the foam fire blocking layers tested show significant and beneficial improvements in seat fire resistance for many ramp and in-flight fire conditions.

2) Both the fabric and the foam fire blocking layers tested show a measurable and beneficial delay and/or limitation in fire spread from simulated post-crash fire sources. In the more severe threats, neoprene foam blocking layers appear to offer more protection than do the fabrics tested.

3) The aluminized fabric tested reduced the seat foam involvement more than did the same fabric without the aluminum coating.

4) As replacements for aircraft seat cushioning foam both polyimide and LS-200 neoprene foams offer a high fire resistance. The former has not yet demonstrated satisfactory functional properties and use of the latter incurs an unreasonable weight penalty.

5) Fire-retardant urethane foam can be replaced with non fire-retardant urethane foam in aircraft seat cushions covered with a blocking layer material without loss in fire protection.

8.1.2 Comparison of Laboratory Test Data to Full Scale Test Results

The results of the laboratory fire tests and the comparison of laboratory and full scale data support the following conclusions.

1) Any one of the laboratory tests can screen fire blocking materials for retarding the burning of the polyurethane foam.

2) The Meeker burner test method indicates configuration-dependant characteristics not evident in other laboratory tests which constrain the entire boundary of the sample and expose it to uniform heating across the entire face.

3) The 181 E-glass fire blocking did show fire blocking performance similar to the aluminized fabric materials under the laboratory test conditions.

4) No laboratory test has had sufficient trial to establish a unique and acceptable fire blocking value for configuration selection.

8.2 Recommendations

The AIA TARC Project 210-9 makes the following recommendations for improving airplane seat fire resistance and for setting a standard for fire resistance control:

1) Airlines, airplane manufacturers, and seat manufacturers should develop seat cushions in airplanes that display as a minimum the fire resistance demonstrated by NORFAB ® 11HT-26-AL (an aluminized fabric) used as a fire blocking layer on FAR 25.853b foam. To prevent seam splitting and barrier rupture from pressure of evolved gases, a pressure relief must be provided without destroying the fire blocking function.

2) Laboratory tests discussed in this report may be used as screening devices for fire blocking layers or for fire resistant seat cushions.

3) Full scale fire testing of E-181 glass fabric should be conducted by the FAA in an attempt to confirm its use as a readily available and consistent fire blocking layer standard for minimum fire resistance.

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4) A fire test on simulated full size seat cushions (bottom and back) including venting should be conducted to confirm the fire resistance of a selected configuration. The radiant heat/propane ignition test set up used by McDonnell Douglas as reported herein has been found adequate. A 2 gallon per hour oil burner test developed by the FAA Technical Center will be evaluated by industry.

   The degree of seat destruction, foam consumption and fire spread as compared to the NORFAB® 11 HT-26-AL wrapped cushion (or E 181 glass fabric, if confirmed acceptable) should be a subjective criteria for acceptability.

   Quality Control of seat construction components other than the fire blocking materials should be by current FAR 25.853 test methods. A QC test method for blocking materials must be developed.

5) Although demonstrating a high fire resistance, neither polyimide nor LS-200 neoprene foam is recommended as a replacement for urethane foam in aircraft seat cushioning.

9.0 REFERENCES

1. Hill, R. G. and Sarkos, C. P., "Effectiveness of Seat Cushion Blocking Layer Materials Against Cabin Fires". FAA Technical Center presentation at 1982 SAE Aerospace Congress and Exposition, October 25-28, 1982 at Anaheim, California.

2. Duskin, Fred E. and Schutter, Kenneth J., "Study for the Optimization of Aircraft Seat Cushion Fire-Blocking Layers - Full Scale - Test Description and Results", McDonnell Douglas Corporation, Final Report for Contract NASA 2-11095, May 1982.

3. Kourtides, D. A., Parker, J. A., Ling, A. C., and Hovatter, W. R., "Optimization of Aircraft Seat Cushion Fire Blocking Layers", U. S. Department of Transportation Final Report No. DOT/FAA/CT-82-132 (July 1982).

4. American Society for Testing Materials, ASTM Committee E-5 on Fire Standards, Working Paper titled "Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products" currently in committee review.

10.0 APPENDICES

10.1 Industry and Government Correspondence

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

1725 DE SALES STREET N.W. WASHINGTON, D.C. 20036 TEL. 347-2315

August 7, 1981

Mr. Jerry M. Chavkin
Chief, Aircraft Engineering Division, AWS-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D. C. 20591

Mr. Roy E. Reichenbach
Chief, Aircraft Safety Development Division, ACT-300
Federal Aviation Administration Technical Center
Atlantic City Airport, New Jersey 08405

Subject: Improved Fire Resistant Aircraft Seat Cushions

Gentlemen:

In November 1980, AIA formed Project 210-9 within the Transport Airworthiness Requirements Committee (TARC) to study the implementation of requirements for improved fire resistant seat cushions for airplanes. Eventual project objectives include definition for AIA members of the following:

1) Current cushion functional characteristics

2) Functional performance guidelines for new cushions

3) Current cushion fire performance

4) Guidelines for improved fire performance within the capability of available materials meeting functional guidelines

The early approach to the objectives included a review of current programs (government and industry) relating to improved cushion fire resistance. To this end, AIA representatives met with FAA Technical Center personnel January 14, 1981 to discuss the large scale fire test program underway there. Also, AIA technical representatives attended a February 10-11, 1981, NASA-sponsored meeting reporting the status of the several NASA-funded development projects for fire resistant seat cushions and an up-date of the FAA Technical Center progress. The TARC Project contacted seat manufacturers and others associated with cushion development. Based on this review, AIA offers the following comments on current status:

(1) Extensive laboratory and full scale testing has narrowed the list of available materials that could be employed to improve the fire resistance of passenger seats of conventional design. Since the density of neoprene is unacceptable and polyimide is not yet developed, polyurethane is the only available cushion material. Fire blocking elements may be Vonar, LS-200 neoprene, Kermel or PBI batting in combination with various fabric layers such as Nomex, PBI (if available) or other suitable fire resistant materials.

(2) A protective blocking layer on the surface of the urethane foam will add substantial weight and labor cost to the seat. The blocking materials are presently available but their optimum configuration for fabricability is not established. Commercial fabrication capability must be established. Once a given blocking construction is established, there will still be a substantial (6 months to a year) lag before installation of such seats could be initiated in aircraft.

(3) The extensive testing of seat cushion configurations and interior lining against several fire sources in the C-133 fuselage at FAA-ACT has yielded voluminous data supporting fire safety benefits from possible changes in seat cushion configuration. However, test condition decisions, test plans, baseline calibration data for the tests, method of test data analysis, and results have not been documented.

(4) The feasibility of one seat cushion fire blocking concept has been demonstrated by limited service tests. An FAA-sponsored optimization program is underway to minimize the impact (wieght) on airplane performance for a similar concept.

(5) FAA planning to establish small scale and/or laboratory tests for certification (regulations) and quality control should be established.

(6) The larger AIA member companies (Lockheed, Boeing, and McDonnell Douglas) are participating in seat cushion and fire test methods development with independent studies.

The AIA wishes to continue use of the best available fire resistant materials in aircraft cabins within reasonable economic and fabrication constraints. The AIA is in full support of a passenger seat cushion fire blocking development program. However, the AIA does have some concerns about the FAA test and development program and wish to address these:

(1) The AIA agrees that seat cushion contribution to cabin fires and the degree of improvement possible within the state of the art must be confirmed by large scale fire tests. The FAA C-133 fire test facility at the Technical Center is the best available instrument to establish these important performance properties quantitatively to maintain program perspective. The AIA recognizes that the current test configuration (large fuselage opening, large fire, minimum fire source entry) was selected to obtain maximum specimen exposure to heat with minimum combustion products from the source to interfere with evaluation of the specimen behavior. However, this condition, while possible, certainly is not typical of post-crash fire incidents in past fatal accidents. The use of only this scenario to evaluate the possible reduction in post crash fire hazard with interior material changes may be misleading. For instance, as the Technical Center has experienced, decreasing the size of the fuselage simulated "rupture" can reduce the effect of seat cushion involvement while increasing significantly the hazard contribution of the fire source.

To obtain a proper perspective of interior material post-crash fire contribution, the AIA recommends that the FAA examine again the accident statistics for past survivable post-crash fire scenarios. With an inert fuselage interior, several scenarios could be tested to determine the threat to interior materials and the life hazard contribution by the fire source. The results obtained from the specific material tests then could be evaluated in light of the likelihood for such a fire condition.

(2) The AIA understands the desire of the FAA to show feasibility for the fire blocking concept by development of a configuration "optimized" for minimum weight, cost, etc. using state of the art materials. However, in the short FAA program it is not possible to evaluate all aspects of design and fabrication. Improvements in passenger seat fire safety standards must not be accomplished by the mandating of particular materials or design. It is recommended that the FAA emphasize the development of small scale and laboratory test methods and standards for seat cushion certification and to assure quality control of configuration and materials employed. The AIA believes the ultimate solution for improved seat cushion fire resistance lies in development of new cushioning concepts eliminating, most certainly, polyurethane foam and possibly all foams. A standard mandating particular materials and design would stifle this development.

The AIA recognizes the time constraints placed upon the FAA Technical Center program and the limitations of the FAA budget and technical staff; however, the impact of a mandated standard configuration could be difficult

to justify. The AIA urges the FAA to reconsider the current program emphasis and to consider alternatives possible with coordinated FAA and AIA technical expertise. These alternatives should include reconsideration of the current C-133 design fire condition and the establishment of a plan for development of new fireworthiness criteria and standards for seat cushions.

Very truly yours,

AEROSPACE TECHNICAL COUNCIL

J. P. Reese, Director
Airworthiness Programs

U.S. Department
of Transportation
**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

October 16, 1981

Mr. J. P. Reese
Director, Airworthiness Programs
Aerospace Industries Association
of America, Inc.
1725 De Sales Street, NW.
Washington, D.C. 20036

Dear Mr. Jack Reese:

This is in reply to your letter of August 7 to this office and to Mr. Roy Reichenbach of the Technical Center, regarding the research and development program for improved fire resistant seat cushions. Mr. Reichenbach, the co-addressee, will reply to your letter separately on those particular program aspects of concern to the Technical Center.

Your expression of support of the program is most welcome. Your comments on page 2 largely reflect our understanding of the program as it stands today. We take some exception to your items 1 and 2. Fire blocking materials may not necessarily be limited to those you have mentioned and they may not increase the weight of the cushion. We are working toward publication of the information mentioned in item 3.

We fully appreciate your concerns with the technical areas discussed on page 3. Considering the advancements which have been made in the program to date, we believe your concerns are being taken into consideration, and that the program will progress to a satisfactory resolution of these issues. On August 25 and 26, subsequent to your letter, an informal meeting was held at the Technical Center with several representatives of the Federal Aviation Administration, the National Aeronautics and Space Administration (NASA), and industry to review the major technical aspects of the research and development work. It was the consensus of that meeting that the evaluation of improved fire resistant cushions should be based on credible fire scenarios, as you have suggested. Work is continuing on the investigation of fire scenarios.

We agree with you that criteria for a cushion should be based on performance rather than on the specification of a particular material or design. Performance criteria which fosters design innovation can promote both the use of fire blocking construction for polyurethane foam and the use of advanced foam materials such as polyimide, and thus give the designer an opportunity to optimize the materials and the cushion design. We are working currently with the NASA and several aircraft manufacturers on the evaluation of a small scale test which will be suitable as a basis for performance criteria. A round-robin test series is being conducted which we hope will guide us in this area.

as the program progresses and you become more familiar with the details that you will find the objectives of the program more to your [illegible] We invite you and your member companies to inquire informally at the Technical Center at your convenience regarding the [illegible] status of the program.

Sincerely,

Jerry Chavkin
Chief, Aircraft Engineering Division
Office of Airworthiness

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NEW JERSEY 08405

DEC 2 1981

Mr. J. P. Reese
Director, Airworthiness Programs
Aerospace Industries Association of America, Inc.
1725 De Sales Street, NW
Washington, DC 20036

Dear Mr. Reese:

This letter is in reply to your letter of August 7, 1981, to this office and to Mr. Jerry Chavkin, of the Office of Airworthiness, regarding the evaluation of seat cushion fire blocking layer materials for fire safety effectiveness. Mr. Chavkin has responded to those aspects of your letter which concern his organization.

We appreciate your appraisal of the C-133 test article as the best available instrument to establish the performance improvement of aircraft seats protected with cushion fire blocking layer materials. We have gathered the majority of the C-133 data, with the primary seat centered at a large fuselage opening adjacent to an external fuel fire. The rationale and test observations behind the selection of a large opening was described in a March 31 letter to Mr. Everett Tustin, Chairman of the Transport Airworthiness Requirements Committee (TARC) on Fire Resistance Seat Cushions. Briefly, as stated in this letter, a large opening provides for better discrimination between the performance of candidate blocking layer materials than does a smaller opening. Because of our very limited supply of cabin lining materials, at this late state of our program we cannot comprehensively evaluate blocking materials at other postcrash fire scenarios, with the aim of calculating potential safety benefit, by factoring in the "likelihood for such a fire condition." Besides, the likelihood or probability of a given aircraft crash fire scenario, to our knowledge, is currently unknown. Your letter is pointing to the need for an analysis of the reduction in fire risk in aircraft accidents as the result of using a seat cushion blocking layer. In this regard, we plan to initiate research this fiscal year to develop a model to deal with risk abatement associated with blocking layers, and later with other cabin fire safety strategies.

With the large opening fire scenario, full-scale tests with the remaining cabin materials in place demonstrated that the application of a commercial foam fire blocking layer would provide approximately 50 seconds improvement in safety. In recent months, we have expanded our scenario studies, not to the extent that you recommended, but to include ramp and in-flight fires, as well as a postcrash fire adjacent to a door opening. The improvements are even more impressive; for example, using realistic ramp and in-flight fire ignition

sources, we can prevent the occurrence of a self-sustaining cabin fire by using a cushion blocking layer.

On page 2 of your letter, you indicate that C-133 test results have not been documented. In this regard, our current plan is for a draft report in January 1982, and a published report in April or May 1982. A similar report date is planned for the FAA-sponsored optimization work at NASA Ames (item 4, page 2).

We share your concern that blocking layer materials should be selected based on a small-scale/laboratory test, not through the mandating of particular materials or design. Subsequent to your letter a working meeting was held at the Technical Center with representatives from FAA, NASA, and industry who agreed to participate in a round-robin test series to evaluate existing test procedures. The cooperation expressed by the parties involved was, I believe, unprecedented in a matter of this kind. A round-robin study is necessary to develop suitable test procedures for materials selection. Although it has been time consuming to secure ample quantities of the 11 material configurations agreed upon at the meeting, we expect these materials to have been delivered during November to the participating laboratories. Testing should be completed by February 1982, and a working meeting will follow as quickly as the data can be tabulated and analyzed.

We appreciate your interest and comments on our seat cushion fire blocking layer test program. If we can be of further assistance, please feel free to contact us at any time.

Sincerely,

R. E. Reichenbach
Chief, Aircraft Safety Development
Division

10.2 OSU Test Results

SUMMARY OSU EVALUATION

AGENCY: BOEING

HEATING RATE: 2.5 W/cm^2

CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - Sec.
1	263.	753.	1235	1898	2107	17.75 17.57	50 90
2	221.	411.	469	622	1133	13.67 5.65	25 270
3	231.	425.	524	955	1895	13.34 8.90	25 275
4	192.	420.	531	787	1241	14.29 4.81	25 300
5	215.	475.	714	1607	1977	12.56 10.81	25 150
6	205.	407.	539	1279	1956	12.32 10.27	25 205
7	243.	467.	638	1546	1983	13.78 11.99	20 155
8	224.	408.	463	745	1274	12.81 5.40	25 205
9	224.	429.	626	1338	1736	13.78 8.38	25 140
10	232.	447.	539	698	929	13.27	25
11	306.	536.	704	1005	1243	17.84	20

SUMMARY OSU EVALUATION AGENCY: DOUGLAS

HEATING RATE: 2.5 W/cm^2 CHARACTERISTIC: HEAT

CONFIG NO.	Q - KW-MIN/m^2					MAX. dQ/dt - KW/m^2	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	dQ/dt	Time - sec.
1	25.2	53.9	104.4	141	160	83 35	59 150
2	17.3	28.1	35.7	47	135	37.5 27.5	55 300
3	-	-	-	-	-	-	-
4	21.5	32.0	38.2	105	188	42.5 43.0	50 231
5	19.1	46.2	105.8	161	202	62.2 40.0	84 200
6	23.2	49.6	126.0	172	213	47 70.1	55 92
7	-	-	-	-	-	-	-
8	17.9	28.9	35.3	41	109	39.2 22.5	51 300
9	18.8	41.9	106.8	145	177	42.0 54.1	58 109
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION AGENCY: FAA-ACT

HEATING RATE: 2.5 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1		13		54	109	.68	204
2		11		48	104	.63	236
3		17		66	143	.81	258
4		12		42	101	.81	260
5		10		50	99	.60	155
6		18		70	138	.95	227
7		21		68	136	.99	207
8		22		61	135	1.07	259
9		14		58	122	.99	211
10		14		52	114	.99	259
11		27		71	143	1.01	261

SUMMARY OSU EVALUATION AGENCY: BOEING

HEATING RATE: 5.0 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1	499.	1219.	1541	1806	1930	21.59 26.38	10 35
2	355.	562.	733	1513	2326	18.19 12.04	10 150
3	347.	551.	724	1691	2273	18.24 13.32	10 125
4	378.	578.	730	1550	2325	20.55 13.75	10 160
5	390.	773.	1237	2214	2450	17.74 18.45	10 95
6	379.	700.	1192	2161	2446	21.23 18.17	10 110
7	393.	694.	1231	1834	2069	20.24 20.18	10 80
8	347.	567.	742	1419	1991	18.52 8.53	10 120
9	352.	644.	1108	1732	1975	18.73 16.73	15 80
10	354.	557.	712	1104	1546	18.71	10
11	450.	744.	942	1168	1387	26.69	10

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SUMMARY OSU EVALUATION

AGENCY: DOUGLAS

HEATING RATE: 5.0 W/cm^2

CHARACTERISTIC: HEAT

CONFIG NO.	Q - KW-MIN/m^2					MAX. dQ/dt - KW/m^2	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	dQ/dt	Time - sec.
1	51.1	68.2	117.7	139	151	75 40	36 120
2	34.6	46.1	97.2	141	182	55 50	22 125
3	-	-	-	-	-	-	-
4	36	49	114	162	201	59 62	17 115
5	51.9	80.7	132.7	165	197	57 79	25 57
6	46.3	81.9	141	175	200	58 77	25 68
7	-	-	-	-	-	-	-
8	35.4	47.8	96.0	132	164	58 47	22 125
9	47	80	127	155	174	55 72	25 66
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION AGENCY: FAA-ACT

HEATING RATE: 5.0 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1		640		1542	1901	16.78	44
2		337		761	1273	15.16	23
3		341		993	1632	15.51	24
4		315		646	932	15.09	24
5		381		1055	1878	13.75	23
6		393		639	1102	14.30	24
7		383		1094	1735	14.80	24
8		339		695	1023	14.95	24
9		356		715	1362	14.88	25
10		346		628	832	15.30	23
11		410		808	1198	17.49	21

SUMMARY OSU EVALUATION AGENCY: BOEING

HEATING RATE: 7.5 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1	617.	1178.	1364	1556	1673	27.00 24.98	7 25
2	357.	524.	681	1618	1859	21.35 15.53	5 130
3	364.	547.	938	1710	1865	22.03 16.73	5 75
4	388.	549.	733	1653	1864	24.53 16.74	5 105
5	442.	1061.	1437	1729	1945	20.41 22.24	5 45
6	351.	682.	1110	1827	2013	15.06 18.91	20 95
7	406.	795.	1308	1654	1748	21.66 19.53	5 75
8	351.	496.	703	1223	1345	20.00 8.75	5 95
9	404.	848.	1215	1506	1700	22.89 18.00	5 55
10	342.	471.	556	718	768	20.82	10
11	954.	677.	773	887	986	31.49	5

SUMMARY OSU EVALUATION

AGENCY: FAA-ACT

HEATING RATE: 7.5 W/cm^2

CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1		837		1802	2042	20.79	48
2		409		1173	1880	16.90	15
3		408		1314	2036	17.69	18
4		379		967	1621	15.44	17
5		433		1632	2304	14.66	17
6		450		1247	2350	16.28	15
7		447		1487	2231	16.28	16
8		405		1040	1786	15.93	18
9		422		1349	1981	15.58	16
10		416		827	1187	17.02	17
11		486		1065	1437	21.08	15

SUMMARY OSU EVALUATION

AGENCY: BOEING

HEATING RATE: 2.5 W/cm^2

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1	20.	95.	122	147	147	2.92 1.23	40 80
2	5.	8.	8	8	59	.59 .75	30 240
3	8.	16.	20	73	203	.86 1.47	30 205
4	5.	9.	10	11	47	.52 .88	30 205
5	6.	23.	52	141	146	1.50 1.14	80 150
6	7.	23.	34	116	154	1.06 1.33	30 120
7	6.	12.	20	88	102	.55 .99	25 150
8	7.	11.	11	33	106	.63 .78	30 175
9	7.	20.	46	117	124	1.24 .87	115 140
10	7.	15.	15	15	16	.67	30
11	7.	10.	13	15	17	.66	25

SUMMARY OSU EVALUATION AGENCY: DOUGLAS

HEATING RATE: 2.5 W/cm^2 CHARACTERISTIC: SMOKE

CONFIG. NO.	INTEGRATED SMOKE RELEASE - SMOKE					MAX SMOKE RELEASE RATE	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	Smoke/m^2	Time - sec.
1	10.3	13.6	21.1	23.3	25.4	39.4 7	52 150
2	1.4	2.1	4.7	21.9	73.9	53.3	302
3	-	-	-	-	-	-	-
4	1.5	1.7	2.7	56.7	69.4	4 41.8	45 223
5	2.7	10.9	23.1	27.5	30.6	27.7	87
6	6.6	16.7	39.8	41.3	42.8	21 31.4	55 81
7	-	-	-	-	-	-	-
8	5.7	9.2	19.5	40.8	96.1	9 47.2	45 302
9	5.2	16.0	35.4	36.5	38.1	18 28.9	60 85
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION

AGENCY: FAA-ACT

HEATING RATE: 2.5 W/cm^2

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1		9		49	96	.97	156
2		8		16	18	.29	44
3		5		12	12	.26	52
4		5		10	10	.19	40
5		7		30	30	.68	72
6		6		26	26	.46	72
7		7		19	19	.29	50
8		4		11	11	.23	42
9		8		32	32	.46	56
10		7		17	17	.32	52
11		15		25	25	.71	50

SUMMARY OSU EVALUATION

AGENCY: BOEING

HEATING RATE: 5.0 W/cm^2

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1	71.	122.	130	133	134	3.20 3.47	15 25
2	30.	68.	50	184	215	2.05 2.28	20 150
3	45.	84.	121	274	295	2.67 2.50	20 120
4	26.	43.	51	178	207	1.56 2.51	20 140
5	24.	65.	113	159	161	1.63 2.07	20 60
6	33.	84.	156	212	215	2.51 2.73	20 65
7	21.	51.	104	114	120	1.18 2.07	15 80
8	41.	59.	82	220	244	2.46 2.15	15 110
9	35.	75.	138	167	174	2.20 2.47	20 80
10	41.	68.	80	104	131	2.44	20
11	20.	35.	45	47	48	1.53	15

SUMMARY OSU EVALUATION AGENCY: DOUGLAS

HEATING RATE: 5.0 W/cm^2 CHARACTERISTIC: SMOKE

CONFIG. NO.	INTEGRATED SMOKE RELEASE - SMOKE					MAX SMOKE RELEASE RATE	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	Smoke/m^2	Time - Sec.
1	23.1	28.3	40.9	44.4	53.2	57 15	22 100
2	19.8	22.32	83.9	97.2	99.7	53 84.4	25 121
3	-	-	-	-	-	-	-
4	20	24	102	114	118	44 109	20 112
5	29.3	37.1	44.5	45.0	46.8	53.3	30
6	28.9	46.8	55.6	56.5	59.5	56 58.2	30 65
7	-	-	-	-	-	-	-
8	21.4	24.1	86.4	100.9	103.4	53 85.3	26 125
9	34	48	54	54	55	65 49	24 55
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION

AGENCY: FAA-ACT

HEATING RATE: 5.0 W/cm^2

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1		62		93	93	2.53	24
2		35		117	172	2.40	22
3		33		142	190	2.24	22
4		35		69	86	1.36	22
5		24		49	72	1.13	24
6		37		39	75	1.87	28
7		20		50	74	.74	30
8		27		82	87	2.01	24
9		29		46	88	1.78	28
10		26		28	28	1.23	24
11		14		19	33	1.04	16

SUMMARY OSU EVALUATION

AGENCY: BOEING

HEATING RATE: 7.5 W/cm^2

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1	98.	141.	142	143	144	4.75 5.00	15 25
2	66.	121.	192	352	354	3.20 3.66	15 100
3	78.	145.	246	329	331	4.39 4.12	10 80
4	68.	122.	192	340	349	3.13 4.06	10 100
5	45.	129.	149	155	161	1.70 3.61	10 40
6	43.	117.	181	216	216	2.69 2.30	25 90
7	38.	104.	153	158	158	2.94 2.51	40 65
8	71.	132.	220	303	309	3.84 3.30	15 80
9	56.	143.	174	178	182	3.22 3.46	15 40
10	56.	90.	112	168	188	3.31	15
11	36.	56.	58	62	68	2.62	10

SUMMARY OSU EVALUATION AGENCY: FAA-ACT

HEATING RATE: 7.5 W/cm^2 CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec,	dD_s/dt	Time - sec.
1		80		106	106	3.20	18
2		60		164	209	2.69	16
3		74		206	263	2.97	16
4		63		152	221	2.21	18
5		30		94	108	1.54	18
6		48		126	215	2.33	18
7		47		95	110	1.13	26
8		63		159	222	2.53	18
9		47		124	159	2.72	18
10		61		95	110	2.08	18
11		22		41	45	1.43	12

PROFESSIONAL AVIATION MAINTENANCE ASSOCIATION INC.

P.O. BOX 12449 GREATER PITTSBURGH INTERNATIONAL AIRPORT PITTSBURGH, PENNSYLVANIA 15231

OFFICE OF THE PRESIDENT

June 24, 1983

Mr. Dan Glickman
Chairman - Subcommittee on
Transportation , Aviation & Materials
Committee on Science and Technology
Suite 2321, Rayburn House Office Bldg
Washington, D.C. 20515

Dear Mr. Glickman:

As President of the Professional Aviation Maintenance Association, I would like to comment and express our views on a matter which is before your committee at the present time. This being the aquisition and distribution of aircraft data, with emphasis on the Service Difficulty Program administered by the FAA.

The Professional Aviation Maintenance Association is non-union, non-profit, and a non-sectarian organization. Its purpose is to increase the professionalism of the individual aviation maintenance technician by greater technical knowledge and by a better understanding of safety requirements. In addition, PAMA establishes communications among maintenance airmen throughout the country, sharing information and useful knowledge.

Since we represent the individual airmen, and no particular organized group, i.e. union or airline, we can best relate to the general aviation Malfunction and Defect Reporting System portion of the Flight Standards Service Difficulty Program #8010-2.

The Malfunction and Defect Reporting System has highlighted hundreds of potential problem areas to thousands of Maintenance Technicians in the General Aviation Airworthiness Alerts, Advisory Circular 43-16. These reports have been a great help to many technicians throughout the industry. PAMA encourages the use of FAA Malfunction and Defect Reporting Systems, however, except as required by FAR 145:63, FAR 145:79, FAR 135:57 and FAR 135:59, all inputs into the system are on a voluntary basis. We feel that a greater participation in the program would result from increased feedback from the FAA Data Bank to individuals which elected to participate in the program. Technicians who spend their time reporting mechanical difficulties would like to see a response for their efforts.

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Mr. Dan Glickman
Chairman, Subcommittee on
Transportation, Aviation & Materials
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Since technicians today tend to specialize in a certain classification of aircraft, a subscription system which would alert individual technicians of service difficulties on the type aircraft he or she performs maintenance on a daily basis would be one of the best forms of communication afforded by the Service Difficulty Program.

This system would not only provide valuable technical information to the technicians, but would also stimulate the participation which the SDR Program relies on for its continued success.

Thank you for your consideration of PAMA's views. If we can be of any further assistance, please feel free to contact us at the National Office in St. Louis, (314) 739-2580, or P.O. Box 248, St. Ann, MO 63074.

Sincerely,

Arthur C. Giessman
President, PAMA

ACG/sd

cc: 5 Copies-Scott Crossfield

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